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BOTANICAL GARDENS[1]

THE ADMINISTRATION OF BOTANICAL GARDENS

THE common idea of a botanical garden appears to be that of a collection of many kinds of plants chiefly marked by their lack of beauty and unattractive arrangement. A fair average impression of most botanical gardens would perhaps be that of large collections of living plants, grouped for reasons of economy and convenience, like the bottles on the shelves of a laboratory, with little regard to their individual or collective appearance: variety and some sort of classification are fundamental elements of this mental picture. It is a question how far this idea may be modified without passing the limits of popular acceptance of any definition that may be given of a botanical garden.

Such gardens originated in the herb gardens of the middle ages, which were almost as natural an outgrowth of the use of simples as a field of wheat or yams was of the use of vegetable food—though later reached. With the teaching of medicine they became demonstration gardens closely limited to the vegetable materia medica. Travel and exploration brought to them the curiosities of the vegetable kingdom. With the development of taxonomy, they have become its exponents, varying into epitomes of local or cosmic plant communities. Morphology and physiology, as these subjects progressively claimed attention, have in turn left their imprint on the gardens. Through it all, variety and economical and

[1] A symposium given before Section G, American Association for the Advancement of Science, at the Boston meeting, Tuesday, December 28, 1909.

convenient arrangement have persisted as dominant characters, the recessives or mutants rarely proving in close enough harmony with environment to hold their own apart, unless protected.

The average botanical garden, in fact, is a museum of living plants, and as such is affected by whatever affects museums of other classes. It exists for the exemplification of coordinated facts; for the provision of material for dissociated demonstration and for study; and, in so far as it can meet the requirement, it is charged with the duty of making such study of its materials. Departure from this average tends to convert it into a show-window, a warehouse or a laboratory, according to the direction and degree of specialization.

The administration of a garden of this type rests upon fundamental principles common to the fields of business, education and research. Few visitors to a museum or a garden carry away a distinct impression of fifty objects, though they have gazed upon and perhaps observed hundreds—while they may have seen thousands. If they have derived pleasure and an impression that the collection is worth while, and have carried away an understanding of something not before so well understood, they are likely to return and to send others to see what they have seen. The second, and especially the last, of these results depends upon some salient feature of the exhibit. Beauty, taste and order may give pleasure and make a collection worth seeing for the general impression it creates; but a lesson is much more often taught than picked up. In this lies a strong reason for supplementing even the greatest collections by synopses of various kinds and for frequently changing or alternating these. This principle is a rule in retail commerce; it is understood in the best museums, and is admirably practised in the display of works of art. The out-of-door plantations of a garden are less tractable in some ways than merchandise, paintings or collections of gems, prepared animals, or such botanical material as is usually found in museums or even in plant houses; but if the arrangement of the grounds is right, these may be supplemented by a great variety of special features knit into or appended to the general plantation in such a way as not to affect its unity of design.

Enough—but not too much—of everything is an essential rule, which applies with increasing force as one passes from the general to the particular—from landscape to lesson; perhaps nowhere so forcefully as in marking an exhibit. Essential are a key-map to the whole, from which its purpose and the location of its larger units are quickly ascertained; group and synopsis markers exemplifying the happy mean between obtrusiveness and obscurity; increasing prominence to the details of supplementary collections; and everywhere and for everything labels showing at least the common and botanical names, the geographic home, and a key to the history of each individual. Too much of or on a label may be as bad as too little, and what I have indicated, if truly and legibly but unobtrusively presented for each specimen, opens the books for all that is known of it and its kind. But when it is transferred from its place among the marshaled reserves to a position in which it exemplifies some special fact it acquires a need of justifying this place which is best met by increased information on its label. A collection of plants, though accurately named, is but a living atlas, the special meaning of which calls for explanatory text; and this, if appreciated, points to strict limitation and descriptive labeling of those parts of a collection which, permanently or tran-

siently, are charged with conveying special information—success in this, as in the choice of material, lying between too little to convey the desired lesson and too much to be examined or understood.

The research use of a garden, as of a museum, introduces considerations quite different from those necessarily encountered in providing for its use as a means of giving pleasure or conveying information, not the least of these being that every dollar spent for these purposes may mean a dollar less for such research. Just as many museums are compelled to limit their activity to the educational display of their treasures, many gardens find no means for doing more than to present object lessons in the vegetable kingdom either to persons who visit them in its quest or by providing demonstration material for the class room. Adequately planned and economically administered to this end, a garden is indispensable wherever botany is taught as a biological science; and few European universities have failed to include it in the equipment of a botanical department. If the department is a live one, the same forces which impel its professors to snatch from teaching some small part of their time and strength for investigation are almost sure to convert a part of the garden into an implement of research.

It is here that one difficulty in defining a botanical garden enters. A very complete gradation might be marked between so typical and well-rounded an establishment as that at Kew and the grounds of one of our agricultural experiment stations—or, to follow another cleavage line, a park planned to convey knowledge of trees and shrubs while serving its main purpose as a breathing place and recreation spot.

Most botanists will probably agree that any adequately planned and conducted garden devoted to the educational demonstration or productive investigation of plants is a botanical garden, irrespective of breadth or specialization in performing these functions. No small part of the cost of maintaining an ordinary botanical garden is incident to the need of making and keeping it presentable and of cultivating in it plants that require much care and the provision of special conditions for their growth. Even with the best that can be done for them, such plants often appear little more happy in their cramped and artificial surroundings than the animals in a menagerie; and as a class they are perhaps even less indicative of the species they are labeled as representing. Necessary as such surrogates may be, they afford a nominal rather than a real foundation for demonstration, morphological investigation or physiological experimentation. For the latter purposes, and particularly the last-named, supplementary research gardens are necessary, where tropical, desert, alpine or marine conditions are afforded by nature. Dissociated from the centers of human activity, as many such establishments must be and as all, perhaps, might profitably be if their purpose is the solution of life problems, they need not necessarily be burdened by the prior liens on the parent garden; and if of independent origin, for specific study, they necessarily should not bear these trammels. Indeed, from such special-purpose research gardens or garden-adjuncts productive results are as confidently to be expected as from the laboratory or the study as contrasted with a table and a book-shelf somewhere in the house. Research gardens of this type, limited to and concentrated on a specific line of inquiry, are likely to appear with increasing frequency in the next few decades. The results that come from them should bear a close ratio in quantity and quality to the freedom for investigation enjoyed

by the men who are privileged to make and use them; and in economy to the absence of cost other than for meeting the needs of the work in progress at any given time. That they are more likely to be adjuncts rather than independent establishments, in the main, is quite probable, because of the impossibility of doing much thorough-going and far-reaching work apart from the university and other centers about which libraries, herbaria, varied laboratories and extensive collections of living plants have clustered, and to which frequent pilgrimages are sure to be necessary.

The arrangement of this program assigns to me only an analysis of the general meaning and administrative problems of botanical gardens, and I am fortunately able to leave to specialists in their several fields the discussion of these phases of botanical gardening that have been touched on only that I might indicate how truly any worthy research plantation is, in fact, a botanical garden.

To the world at large, nevertheless, a botanical garden is likely to continue to mean, as it now means, a place where plants are attractively and instructively displayed —a museum of living plants. Professor Britton will tell, more forcibly than I could, of its duty to the public, and of the succor to be hoped for from the public that makes it very unwise to overlook this fact, even for a moment. Rather than the garden which is an adjunct to the class room and laboratory, and the research garden pure and simple, therefore, *the* botanical garden of the future, *par excellence*—the garden that appeals to the community as being worth while and that reaches beyond the confines of the class room and the laboratory in its direct usefulness—is likely to adopt in its administration more and more the best rules of museum administration, to appeal to the esthetic sense first, that through it the mind—and perhaps ultimately and incidentally the pocket-book—may be reached. Only so can it reach its goal as a force in education, and through this come into its own as a maker as well as a giver. To do this, it must be beautiful as well as varied, specialized and didactic; and its interest and attractiveness must last through the seasons. Few educational synopses or research plantations are capable of standing this test, and a fatality seems to attend their continued maintenance. In my judgment, the botanical garden of the future that is to appeal to the public like those that (as the one at Kew) most forcefully make this appeal to-day, will be devoted primarily to the presentation of plants in great variety, careful culture and artistic arrangement, and at once exemplifying and indexed by an understood taxonomy; teaching special lessons and reaching special ends through adequate supplementation.

Guided by a botanist whose first love is a broad comparative knowledge of the vegetation of the earth, planned by an artist whose skill can convert the picture of his mind into something that the eye can see, cared for by a gardener to whom a dandelion or a dock in place is as desirable as an oak or an orchid out of place is undesirable, such a garden calls for the further constant care of the teacher to insure through unceasing watchfulness that what is intended to be educational shall be kept from becoming near-demonstration, and the alert supervision of the investigator in each field of research so that experiment may not turn into chance and supposedly adequate resources prove quite inadequate when drawn on at a critical moment. These talents are rarely if ever embodied in one person. The garden that is to profit by them is likely to cherish their possessors in the order indicated, even though, finally, in

taking rank in the achievement of its highest aim—the enlargement of knowledge—there are last which shall be first and there are first which shall be last.

WILLIAM TRELEASE

THE BOTANIC GARDEN AS A FIELD MUSEUM OF AGRICULTURE

A FULLY equipped botanic garden serves more or less strongly a variety of useful purposes. To the public at large its chief function may appear to be that of a park or amusement ground where the dweller in flats may find, amid the fresh beauties of a productive soil, rest and refreshment for his soul, wearied by the daily dash over a city's well fertilized but unproductive pavement, and where the nurse-maid may sit reposefully on a shaded bench and give her charge a needed airing without fear of death by passing automobiles or beer wagons. To one interested in plants for their own sake, the botanic garden often means a place where may be found growing in conservatories or in the open rare plants of native and foreign origin—strange types that travelers tell us of in their wonder books—tree ferns, palms and exotic orchids. In European gardens American trees may be most strikingly present, while in American gardens it is the European trees that catch our eyes. The botanic garden is not, however, merely a species of plant circus that the curious may enter with the expectation of being surprised at oddities in nature and horticulture. It is primarily an attempt to represent the different types of vegetation of the world. In so doing, however, the native and agricultural flora is generally neglected on the perhaps not unnatural ground of its familiarity.

It is not in my province to discuss the various departments and aims of a modern botanic garden. I wish to speak as a teacher chiefly of the economic section already in botanic gardens, and to make some suggestions for its further development.

A systematically arranged and well-labeled botanic garden may be called a dictionary of living plants. You look up the family, the genus or the species and you find the meaning in the growing specimens or you find the known plant, and the label gives you its name and classification. Plants are not excluded from the subject-matter of the young child's continual search for the names of things. It is the fear of his frightful question, "What is it?" that has been the end of many a teacher's attempt to give simplified botany or nature study in the lower schools. To a teacher, if a botanic garden is to serve as a plant dictionary, it should be built on the type of a school or pocket dictionary. Botanic gardens are perhaps too often on the plan of those dictionaries of rarer words that have several times been published. In such a dictionary, says the author, it is needless to give common words familiar to all, as house, church and the like. Only those less familiar words, then, need be included which are at all likely to give trouble to a reading public such as pragmatism, esoteric and the like. A botanic dictionary on this plan might be expected to throw out such simple words as root, leaf and bud; but for the sake of the beginner who may stand abashed at the tangled mass of Greek and Latin roots that confront him in his pathway up the steep ascent of botanic knowledge, explicit definition might be expected of such words as "the law of priority," heterotypic division, and of the recent verbal immigrants of Greek origin not yet out of the quarantine of public opinion. Few of these dictionaries of rarer words are actually in use, for practise has shown that on the whole it is the common

words which are most often looked up in a dictionary. I do not have to remind the members of the section that at the Washington meeting in 1903, a committee was appointed to define the simple word "bud," and their difficulties apparently have been so great as to prevent them reaching a unanimous conclusion, since no report of this committee has been recorded.

In the Connecticut Agricultural College an attempt has been made to establish a garden largely on the plan of the pocket dictionary and a concrete description of what has been accomplished and what has been planned for this garden, may perhaps be the best method of bringing before the section what I have to say on the subject assigned me.

The public for which this garden has been planned is composed, first of regular students in the agricultural college, secondly of students in the summer school who are for the most part teachers throughout the state, and thirdly of visitors who are more or less interested in agriculture.

One section is devoted to school gardens, which are planted and kept in condition by school children of the neighborhood, and which serve as examples to the members of the summer school class in school gardening.

The largest division is the systematic section. In it are grown, arranged according to their family relationships, in full plots 9×5 feet in size or in half plots, all the chief species of agricultural importance in the state. So far as conditions will allow, the different plants are grown in the same way in which they are cultivated as farm or garden crops, and this section might well, therefore, be called a "crop garden." The familiar weeds, however, and some of the commoner wild plants are included in their proper order along with the economic forms. The Solanaceæ may serve as an example of the arrangement of one of the families. A plot of cherry tomato heads the row and with its small berry of two carpels shows the primitive condition of fruit. This is followed by varieties to show the modifications in the fruit brought about through cultivation in size, shape, color, texture of coat and number of carpels. In the row are also represented varieties of egg plant, peppers, potato, black nightshade and its more cultivated, though morganatic sisters—the garden huckleberry and wonderberry, as well as bitter sweet; petunias—single and the derived double-flowered form; tobacco; jimson weed, and matrimony vine. In a similar fashion the Leguminosæ, Gramineæ, the Cruciferæ and the more important genera are represented by native and cultivated forms.

The question which decides the admission of a native form is not, "Is it rare?" but "Is it common?" Perhaps the rarest flowers in the garden are those that are seen on such common biennials as cabbage, beets and parsnips which are planted the second year and allowed to show their systematic position by their flowers and fruit. The commoner ornamental plants are not neglected. Among the Compositæ, for example, dahlias, sunflowers and golden glow will be found alongside of lettuce and chicory, and among the Liliaceæ day lilies are found as well as leeks and onions. It is a continual source of wonder to the visiting agriculturalist to see in a botanic garden the dandelion lying down by the side of the lamb's quarters, and both led to live within bounds a life of unobnoxious cultivation. These weeds, as also the pig-weed and "pusley" scorned by the farmer, are known to every boy with the hoe, yet experience shows that their names are often confused. The very commonness of the dandelion makes it all the better as a type to head the row of the composite family.

Edible fruits are left to ripen on the

plants, and seem to have an educational value in that they attract students to the garden, where they may unconsciously have botanical knowledge thrust upon them. Certain it is that the freshmen who made voluntary investigation of the Cucurbitaceæ this last fall have come to appreciate the distinguishing characters of some members of the order—if one can judge by the number of citrons that were found opened by mistake for watermelons.

Where possible the primitive wild form is grown to show the improvement which has been brought about under cultivation. Thus, seed has been obtained of the wild tobacco (*Nicotiana rustica*) of *Triticum dicoccoides*, recently discovered in Palestine, and considered the source of emmer wheat; vines of native grapes and of *Vitis vinifera* show the sources from which our cultivated varieties have been compounded.

A third division is devoted to pathology. A few of the great groups of parasitic fungi may be represented, such as corn smut, wheat rust, with its alternate form on barberry, black knot of cherry, etc. A variety of bean susceptible to anthracnose will be grown in a plot adjacent to an immune variety, and a striking demonstration of the value of immune races may be expected. Plots can be sown with a mixture of grain and weed seeds and the effect of spraying with iron salts upon the competing plants be shown. The "calico" or mosaic disease of tobacco is a convenient type to illustrate a disease which is transmitted by inoculation, but which is apparently not caused by any living organism. Every other plant touched in a row with an infected leaf will contract the disease, and will form a sharp contrast to the uninoculated individuals left as controls. Non-infectious chlorosis of leaves and chlorosis through grafting may be better illustrated in shrubby forms.

A fourth section of the garden contains specimens to illustrate the laws of variation and heredity. Variations are the building stones out of which the plant-breeder forms his new "creations," and as such should be well classified. Variation in vigor of growth or in qualities of fruit may be due to inherent characters in the germ, which are more or less hereditary and therefore capable of transmission, or on the other hand they may be the response of the plants to recognizable differences in their environment. In the latter group would come the increased growth due to an increase of available food supply. For an illustration there may be grown plots of tobacco in poorly and richly manured soil to show the effect of abundance and lack of food in the substratum. The contrast between the growth of corn sown separately in hills, and the same plant sown thickly in drills, will show the effect of lack of food brought about by competition. In practise tobacco seed is blown, the light which produce small plants being rejected and the heavier reserved for sowing. Plots of tobacco from heavy and light seed, respectively, may be used to show the variation in adult plants due to the differing amount of storage food in the seed.

Fluctuating variations about a mean may be shown by sowing seeds from a single parent and comparing the offspring in respect to a single character. Plants can be grown to show in how far a selection of these fluctuations may be able to change the characters of a given plant. Indian corn furnishes a good example, since in addition to changes in the percentage content of protein, fat and starch in the grain, other clearly defined characters, such as the number, size and position of the ears on the plant, and the number of grains to the ear, have been shown to be markedly influenced by such selection.

Ever-sporting varieties may be illustrated by such races as the five-leaved clover of de Vries and his fasciated teasel. The theory of mutation can not be better illustrated than by the classical example of Lamarck's evening primrose with some of its most striking mutants.

Hybridization, as one of the most important means of effecting changes in combination of plant characters, demands a prominent consideration in the section of the garden under discussion. Mendel's law can perhaps best be shown by hybrids between white- and scarlet-flowered races of a free-blooming species like the scarlet runner bean in which the color characters are evident in vegetative as well as in floral parts, and the assumption of color factors is not necessary to explain the color relations of the offspring. If suitable examples can be obtained, blend and mosaic hybrids might also be illustrated.

Due to hybridization and other causes, the sexually formed seed can not be depended upon to reproduce the characters of the parents without change. Vegetative means of reproduction such as cuttings, since they merely increase the individual plant, do, however, reproduce individual characters. Sowings from seeds and roots respectively, from a single plant of some modern type of dahlia would show the truth of the saying, that cuttings come true, but seedlings do not.

It has been the writer's practise to have each student choose some single plant for personal investigation to find out from the plant itself as much as possible without unfavorable prejudice from literature. The amount of work has been largely voluntary and a reasonable proportion of the students have responded to the suggestions offered them for this elementary research work. A portion of the garden is reserved for carrying out cultures and experiments, which the students themselves may suggest, in connection with their plants under investigation.

The special type of botanic garden which has thus been outlined by specific examples is the outgrowth of the needs of a teaching botanist in an agricultural institution. It has furnished material for demonstration purposes, for laboratory exercises and for field observations. Its systematic section being built on the plan of the pocket dictionary with the most used forms represented has been considered as forming a not unnatural basis of a student's list of recognizable plants, and accordingly ability to identify the species grown in the garden has been expected of students taking botany.

Though the chief function of the agricultural botanic garden may be considered as being instructional for special courses, it should prove of interest to students outside their classes and to a visiting public. It may, therefore, be not inappropriately termed a field museum of agriculture.

A. F. Blakeslee

THE PSYCHOLOGY OF SOCIAL CONSCIOUSNESS IMPLIED IN INSTRUCTION[1]

I have been asked to present the social situation in the school as the subject of a possible scientific study and control.

The same situation among primitive people is scientifically studied by the sociologist (folk-psychologist). He notes two methods in the process of primitive education. The first is generally described as that of play and imitation. The impulses of the children find their expression in play, and play describes the attitude of the child's consciousness. Imitation defines the form of unconscious social control

[1] Read before Section L—Education. American Association for the Advancement of Science, Boston, December, 1909.

exercised by the community over the expression of childish impulse.

In the long ceremonies of initiation education assumed a more conscious and almost deliberate form. The boy was induced into the clan mysteries, into the mythology and social procedure of the community, under an emotional tension which was skilfully aroused and maintained. He was subjected to tests of endurance which were calculated not only to fulfil this purpose, but also to identify the ends and interests of the individual with those of the social group. These more general purposes of the initiatory ceremonies were also at times cunningly adapted to enhance the authority of the medicine man or the control over food and women by the older men in the community.

Whatever opinion one may hold of the interpretation which folk-psychology and anthropology have given of this early phase of education, no one would deny, I imagine, the possibility of studying the education of the savage child scientifically, nor that this would be a psychological study. Imitation, play, emotional tensions favoring the acquirement of clan myths and cults, and the formation of clan judgments of evaluation, these must be all interpreted and formulated by some form of psychology. The particular form which has dealt with these phenomena and processes is social psychology. The important features of the situation would be found not in the structure of the idea to be assimilated considered as material of instruction for any child, nor in the lines of association which would guarantee their abiding in consciousness. They would be found in the impulse of the children expressed in play, in the tendency of the children to put themselves in the place of the men and women of the group, *i. e.*, to imitate them in the emotions which consciousness of themselves in their relationship to others evoke, and in the import for the boy which the ideas and cults would have when surcharged with such emotions.

If we turn to our system of education we find that the materials of the curriculum have been presented as percepts capable of being assimilated by the nature of their content to other contents in consciousness, and the manner has been indicated in which this material can be most favorably prepared for such assimilation. This type of psychological treatment of material and the lesson is recognized at once as Herbartian. It is an associational type of psychology. Its critics add that it is intellectualistic. In any case it is not a social psychology, for the child is not primarily considered as a self among other selves, but as an *apperceptionsmasse*. The child's relations to the other members of the group, to which he belongs, have no immediate bearing on the material nor on the learning of it. The banishment from the traditional school work of play and of any adult activities in which the child could have a part as a child, *i. e.*, the banishment of processes in which the child can be conscious of himself in relation to others, means that the process of learning has as little social content as possible.

An explanation of the different attitudes in the training of the child in the primitive and in the modern civilized communities is found, in part, in the division of labor between the school on the one side, and the home and the shop or the farm on the other. The business of storing the mind with ideas, both materials and methods, has been assigned to the school. The task of organizing and socializing the self to which these materials and methods belong is left to the home and the industry or profession, to the playground, the

street and society in general. A great deal of modern educational literature turns upon the fallacy of this division of labor. The earlier vogue of manual training and the domestic arts before the frank recognition of their relation to industrial training took place, was due in no small part to the attempt to introduce those interests of the child's into the field of his instruction which gathers about a socially constituted self, to admit the child's personality as a whole into the school.

I think we should be prepared to admit the implication of this educational movement—that however abstract the material is which is presented and however abstracted its ultimate use is from the immediate activities of the child, the situation implied in instruction and in the psychology of that instruction is a social situation; that it is impossible to fully interpret or control the process of instruction without recognizing the child as a self and viewing his conscious processes from the point of view of their relation in his consciousness to his self, among other selves.

In the first place, back of all instruction lies the relation of the child to the teacher and about it lie the relations of the child to the other children in the school-room and on the play-ground. It is, however, of interest to note that so far as the material of instruction is concerned an ideal situation has been conceived to be one in which the personality of the teacher disappears as completely as possible behind the process of learning. In the actual process of instruction the emphasis upon the relation of pupil and teacher in the consciousness of the child has been felt to be unfortunate. In like manner the instinctive social relations between the children in school hours is repressed. In the process of memorizing and reciting a lesson, or working out a problem in arithmetic a vivid consciousness of the personality of the teacher in his relationship to that of the child would imply either that the teacher was obliged to exercise discipline to carry on the process of instruction, and this must in the nature of the case constitute friction and division of attention, or else that the child's interest is distracted from the subject matter of the lesson, to something in which the personality of the teacher and pupil might find some other content; for even a teacher's approval and a child's delight therein has no essential relation to the mere subject matter of arithmetic or English. It certainly has no such relationship as that implied in apprenticeship, in the boy's helping on the farm or the girl's helping in the housekeeping, has no such relationship as that of members of an athletic team to each other. In these latter instances the vivid consciousness of the self of the child and of his master, of the parents whom he helps and of the associates with whom he plays is part of the child's consciousness of what he is doing, and his consciousness of these personal relationships involves no division of attention. Now it had been a part of the fallacy of an intellectualistic pedagogy that a divided attention was necessary to insure application of attention—that the rewards, and especially the punishments, of the school hung before the child's mind to catch the attention that was wandering from the task, and through their associations with the schoolwork to bring it back to the task. This involves a continual vibration of attention on the part of the average child between the task and the sanctions of school discipline. It is only the psychology of school discipline that is social. The pains and penalties, the pleasures of success in competition, of favorable

mention of all sorts implies vivid self-consciousness. It is evident that advantage would follow from making the consciousness of self or selves which is the life of the child's play—on its competition or co-operation—have as essential a place in instruction. To use Professor Dewey's phrase, instruction should be an interchange of experience in which the child brings his experience to be interpreted by the experience of the parent or teacher. This recognizes that education is interchange of ideas, is conversation—belongs to a universe of discourse. If the lesson is simply set for the child—is not his own problem—the recognition of himself as facing a task and a task-master is no part of the solution of the problem. But a difficulty which the child feels and brings to his parent or teacher for solution is helped on toward interpretation by the consciousness of the child's relation to his pastors and masters. Just in so far as the subject matter of instruction can be brought into the form of problems arising in the experience of the child—just so far will the relation of the child to the instructor become a part of the natural solution of the problem—actual success of a teacher depends in large measure upon this capacity to state the subject matter of instruction in terms of the experience of the children. The recognition of the value of industrial and vocational training comes back at once to this, that what the child has to learn is what he wants to acquire, to become the man. Under these conditions instruction takes on frankly the form of conversation, as much sought by the pupil as the instructor.

I take it therefore to be a scientific task to which education should set itself that of making the subject matter of its instruction the material of personal intercourse between pupils and instructors, and between the children themselves. The substitution of the converse of concrete individuals for the pale abstractions of thought.

To a large extent our school organization reserves the use of the personal relation between teacher and taught for the negative side, for the prohibitions. The lack of interest in the personal content of the lesson is in fact startling when one considers that it is the personal form in which the instruction should be given. The best illustration of this lack of interest we find in the problems which disgrace our arithmetics. They are supposed matters of converse, but their content is so bare, their abstractions so raggedly covered with the form of questions about such marketing and shopping and building as never were on sea or land, that one sees that the social form of instruction is a form only for the writer of the arithmetic. When further we consider how utterly inadequate the teaching force of our public schools is to transform this matter into concrete experience of the children or even into their own experience, the hopelessness of the situation is overwhelming. Ostwald has written a text-book of chemistry for the secondary school which has done what every text-book should do. It is not only that the material shows real respect for the intelligence of the student, but it is so organized that the development of the subject matter is in reality the action and reaction of one mind upon another mind. The dictum of the Platonic Socrates, that one must follow the argument where it leads in the dialogue, should be the motto of the writer of text-books.

It has been indicated already that language being essentially social in its nature thinking with the child is rendered concrete by taking on the form of conversation. It has been also indicated that this can take place only when the thought has reference to a real problem in the experi-

ence of the child. The further demand for control over attention carries us back to the conditions of attention. Here again we find that traditional school practise depends upon social consciousness for bringing the wandering attention back to the task, when it finds that the subjective conditions of attention to the material of instruction are lacking, and even attempts to carry over a formal self-consciousness into attention, when through the sense of duty the pupil is called upon to identify the solution of the problem with himself. On the other hand, we have in vocational instruction the situation in which the student has identified his impulses with the subject matter of the task. In the former case, as in the case of instruction, our traditional practise makes use of the self-consciousness of the child in its least effective form. The material of the lesson is not identified with the impulses of the child. The attention is not due to the organization of impulses to outgoing activity. The organization of typical school attention is that of a school self, expressing subordination to school authority and identity of conduct with that of all the other children in the room. It is largely inhibitive—a consciousness of what one must not do, but the inhibitions do not arise out of the consciousness of what one is doing. It is the nature of school attention to abstract from the content of any specific task. The child must give attention *first* and *then* undertake any task which is assigned him, while normal attention is essentially selective and depends for its inhibitions upon the specific act.

Now consciousness of self should follow upon that of attention, and consists in a reference of the act, which attention has mediated, to the social self. It brings about a conscious organization of this particular act with the individual as a whole —makes it his act, and can only be effectively accomplished when the attention is an actual organization of impulses seeking expression. The separation between the self, implied in typical school attention, and the content of the school tasks, makes such an organization difficult if not impossible.

In a word attention is a process of organization of consciousness. It results in the reenforcement and inhibitions of perceptions and ideas. It is always a part of an act and involves the relation of that act to the whole field of consciousness. This relation to the whole field of consciousness finds its expression in consciousness of self. But the consciousness of self depends primarily upon social relations. The self arises in consciousness *pari passu* with the recognition and definition of other selves. It is therefore unfruitful if not impossible to attempt to scientifically control the attention of children in their formal education, unless they are regarded as social beings in dealing with the very material of instruction. It is this essentially social character of attention which gives its peculiar grip to vocational training. From the psychological point of view, not only the method and material but also the means of holding the pupils' attention must be socialized.

Finally a word may be added with reference to the evaluations—the emotional reactions—which our education should call forth. There is no phase of our public school training that is so defective as this. The school undertakes to acquaint the child with the ideas and methods which he is to use as a man. Shut up in the history, the geography, the language and the number of our curricula should be the values that the country, and its human institutions, have; that beauty has in nature and

art; and the values involved in the control over nature and social conditions.

The child in entering into his heritage of ideas and methods should have the emotional response which the boy has in a primitive community when he has been initiated into the mysteries and the social code of the group of which he has become a citizen. We have a few remainders of this emotional response, in the confirmation or conversion and entrance into the church, in the initiation into the fraternity, and in the passage from apprenticeship into the union. But the complexities of our social life, and the abstract intellectual character of the ideas which society uses have made it increasingly difficult to identify the attainment of the equipment of a man with the meaning of manhood and citizenship.

Conventional ceremonies at the end of the period of education will never accomplish this. And we have to further recognize that our education extends for many far beyond the adolescent period to which this emotional response naturally belongs. What our schools can give must be given through the social consciousness of the child as that consciousness develops. It is only as the child recognizes a social import in what he is learning and doing that moral education can be given.

I have sought to indicate that the process of schooling in its barest form can not be successfully studied by a scientific psychology unless that psychology is social, *i. e.*, unless it recognizes that the processes of acquiring knowledge, of giving attention, of evaluating in emotional terms must be studied in their relation to selves in a social consciousness. So far as education is concerned, the child does not become social by learning. He must be social in order to learn.

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STATISTICS OF FOREIGN UNIVERSITIES

THE accompanying table shows the enrollment during the winter semester (1909–10) at the universities of the German Empire, at all of the Swiss universities except Neuchâtel, and at several of the Austrian and Hungarian universities, the figures having been furnished in each instance by an officer of the institution concerned. The division into the four traditional faculties of theology, law, medicine and philosophy has been adhered to, no attempt being made to subdivide the last mentioned faculty into the two groups —(*a*) philosophy, philology and history, (*b*) mathematics and the natural sciences —represented at most of the institutions in the list. Nor has any attempt been made to provide special categories for dentistry, pharmacy, forestry, agriculture, etc., the custom being to include dentistry under medicine (or philosophy) and the other subjects under philosophy.

It will be seen from the table that 58,342 students were in attendance at the German universities, 93.5 per cent. of these being men and 6.5 per cent. women. The matriculated students constituted 90.8 per cent. of the grand total and the auditors 9.2 per cent. Of the matriculated students 96.5 per cent. were men and only 3.5 per cent. women, there being practically no women enrolled in theology and only a few in law, the great majority being found in philosophy. Of the auditors, on the other hand, no less than 36.3 per cent. were women—Göttingen, Greifswald, Königsberg, Marburg, Rostock, Strassburg and Würzburg all having more female than male auditors. Almost one half (49.4 per cent.) of the matriculated students are enrolled in the faculty of philosophy, law coming next with 21.9 per cent., then medicine with 21.1 per cent., and finally theology with 7.6 per cent.

Institutions [Winter Semester, 1909–10]	Matriculated Students												Auditors			Grand Total		
	Theology		Law		Medicine		Philosophy		All Faculties									
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Total		Men	Women	Total	Men	Women	Total
A—German																		
Berlin	364	3	2506	6	1499	147	4241	476	8610	632	9242		724	353	1077	9334	985	10319
Bonn	403		806	1	354	16	1901	117	3464	134	3598		171	111	282	3635	245	3880
Breslau	349		560		396	18	970	66	2275	84	2359		205	195	400	2480	279	2759
Erlangen	139		247		282	12	436	7	1104	19	1123		42	22	64	1146	41	1187
Freiburg	218		409	6	681	37	773	43	2081	86	2167		91	47	138	2172	133	2305
Giessen	70		165	3	310	21	679	13	1224	37	1261		93	59	152	1317	96	1413
Göttingen	117		431	1	252	10	1270	149	2070	160	2230		55	57	112	2125	217	2342
Greifswald	118		205		209	2	385	38	917	40	957		50	51	101	967	91	1058
Halle	306	1	453		324	8	1283	18	2366	27	2393		179	88	267	2545	115	2660
Heidelberg	62		399	6	463	50	868	86	1792	142	1934		103	52	155	1895	194	2089
Jena	43		282	1	303	10	868	13	1496	24	1520		67	52	119	1563	76	1639
Kiel	48		442		498	9	640	9	1631	18	1649		61	49	110	1692	67	1759
Königsberg	80		308	1	332	15	602	30	1322	46	1368		98	110	208	1420	156	1576
Leipzig	347		899		746		2769		4702	59	4761		755	114	869	5457	173	5630
Marburg	118	1	434		335	8	953	29	1840	38	1878		14	31	45	1854	69	1923
München	177		1423	8	2075	73	2884	102	6559	183	6742		375	204	579	6934	387	7321
Münster	313		443		215	3	881	46	1852	49	1901		121	45	166	1973	94	2067
Rostock	49		62		171	1	422	2	704	3	707		27	36	63	731	39	770
Strassburg	209		409	2	364	13	985	13	1967	28	1995		66	122	188	2033	150	2183
Tübingen	427		367		298	10	645	13	1737	23	1760		75	68	143	1812	91	1903
Würzburg	86		297		609	8	422	2	1414	10	1424		48	87	135	1462	97	1559
Total	*4048*		*11585*		*11187*		*26149*		*51127*	*1842*	*52969*		*3420*	*1953*	*5373*	*54547*	*3795*	*58342*
B—Austrian (incl. Hungarian)																		
Budapest	86		3619		1814	63	967	134	6486	197	6683		731	65	796	7217	262	7479
Czernowitz	131		573		—		152	9	856	9	865		122	67	189	978	76	1054
Innsbruck	337		266		213		186		1002		1002		174	51	225	1176	51	1227
Klausenburg			1497		321		298				2116				191			2307
Krakau	86		1307		446	48	701	182	2540	230	2770		232	209	441	2772	439	3211
Wien	219		3418		1791	77	1880	194	7308	271	7579		1579	422	2001	8887	693	9580
C—Swiss																		
Basel	54		59		188	7	347	14	648	21	669		52	61	113	700	82	782
Bern	48		403	3	548	224	627	118	1626	345	1971		358	178	536	1984	523	2507
Freiburg	235		124		—		237	8	596	8	604		39	81	120	635	89	724
Genève	23		253	19	252	372	298	235	826	626	1452		136	327	463	962	953	1915
Lausanne	14		147	12	164	159	365	103	690	274	964		117	152	269	807	426	1233
Zürich	29		276	13	355	191	496	114	1156	318	1474		208	193	401	1364	511	1875

In point of total attendance (matriculated students and auditors) the German institutions rank as follows: (1) Berlin, (2) München, (3) Leipzig, (4) Bonn, (5) Breslau, (6) Halle, (7) Göttingen, (8) Freiburg, (9) Strassburg, (10) Heidelberg, (11) Münster, (12) Marburg, (13) Tübingen, (14) Kiel, (15) Jena, (16) Königsberg, (17) Würzburg, (18) Giessen, (19) Erlangen, (20) Greifswald and (21) Rostock. It should be remembered that the summer semester (1909) is not included in the figures, and also that several institutions, notably those located in the pleasantly situated smaller towns, have a larger attendance in the summer than in the winter. If the matriculated students only are considered, Halle would change places with Breslau, and Würzburg with Königsberg. The University of Tübingen leads in

the number of theological students, with Bonn, Berlin, Breslau and Leipzig following in the order named. In law the order is Berlin, München, Leipzig, Bonn and Breslau; in medicine München, Berlin, Leipzig, Freiburg and Würzburg, and in philosophy, Berlin, München, Leipzig, Bonn and Göttingen. Berlin attracts the most matriculated women, followed by München, Göttingen, Heidelberg and Bonn, whereas in the total number of female students, including auditors, Berlin is followed by München, Breslau, Bonn and Göttingen. The largest numbers of auditors are found at Berlin, Leipzig, München, Breslau and Bonn, in the order named.

Vienna is by far the largest of the Austrian universities, being surpassed in point of attendance only by Berlin among the German institutions, while the largest Swiss institution is the University of Bern, this being followed by Genève, Zürich, Lausanne, Basel, Freiburg and Neuchâtel. The Universities of Czernowitz and Freiburg (Switzerland) have no medical faculties. The percentage of matriculated women students at the Swiss universities (22.3 per cent.) is much higher than that (3.5 per cent.) at the German institutions, while with the exception of Bern and Zürich the Swiss universities all attract more female than male auditors.

If we compare the attendance at the German universities during the winter semester of 1909–10 with that of 1893–94,[1] we shall find that the number of matriculated students has more than doubled during this period, the gain being one of 113 per cent., *i. e.*, from 27,424 to 58,342. There were almost as many students enrolled in the faculty of philosophy alone this year as there were in all four faculties sixteen years ago, and almost as many students of medicine in 1893–94 as there were of philosophy in that year. The number of law students was exceeded by that of medical students sixteen years ago, whereas to-day the condition is reversed. The number of students of theology has shrunk from 4,587 to 4,048 during the period under consideration, or from 16.7 per cent. to 7.6 per cent. of the total number of matriculated students enrolled. The number of law students has increased from 7,024 to 11,585, but the percentage has dropped from 25.6 per cent. to 21.9 per cent., while in the case of the students of medicine there has been an actual increase from 7,856 to 11,187 accompanied by a decrease in percentage from 28.7 per cent. to 21.1 per cent. The number of students under the faculty of philosophy has more than tripled during the sixteen-year period under review, the percentage increase being one from 29 per cent. to 49.4 per cent. There may be some discrepancies in the classification of students of veterinary medicine, pharmacy, dentistry and the like, as between 1893–94 and 1909–10, but they are not likely to be of sufficient moment to affect the general situation.

There has also been a marked change in the relative position of the various German universities since 1893–94. Leaving auditors out of consideration, the institutions in the year mentioned ranked as follows from the standpoint of attendance: (1) Berlin, (2) München, (3) Leipzig, (4) Halle, (5) Würzburg, (6) Bonn, (7) Breslau, (8) Tübingen, (9) Erlangen, (10) Freiburg, (11) Heidelberg, (12) Strassburg, (13) Marburg, (14) Göttingen, (15) Greifswald, (16) Königsberg, (17) Jena, (18) Giessen, (19) Kiel, (20) Rostock and (21) Münster, the last mentioned institution possessing no law and medical schools

[1] The 1893–94 figures are based on the reports of the various institutions in volume 4 (1894–95) of *Minerva*.

in 1894. The only university that shows a decrease in the attendance of matriculated students this year as against 1894 is Würzburg, and there the loss is very slight, from 1,442 to 1,424. The largest gains in actual number of students have been made by Berlin, München, Bonn, Leipzig, Münster and Göttingen, in the order named, while the largest relative (percentage) increases have been registered by Münster, Kiel, Göttingen, Bonn, Giessen, Jena and Marburg. It is interesting to note that there are three large cities in the first group, and not one in the second, so that we may say, speaking broadly, that the institutions located in the smaller cities have experienced a greater *relative* gain than those in the large cities, while, on the other hand, the universities of Berlin, München and Leipzig alone have to their credit 37 per cent. of the gain in actual number of matriculated students made at all of the institutions together since 1894.

The following figures taken from the second volume of the report of the commissioner of education for the year ended June 30, 1909, may be of interest. They illustrate the growth of the professional schools of theology, law and medicine in our own country, and it will be seen that, contrary to the conditions in Germany, theology does not show a loss, whereas medicine, on the other hand, exhibits an increase when compared with 1890, but a decrease since 1900; law has made constant and rapid progress. Unfortunately no figures for the school of philosophy are available for the United States. In comparing the American with the German figures, it should also be borne in mind that the general standards for admission to professional courses of study in Germany are much higher than they are in our own country.

NUMBER OF STUDENTS IN ATTENDANCE AT THE PROFESSIONAL SCHOOLS OF THEOLOGY, LAW AND MEDICINE IN THE UNITED STATES

	1908–1909	1907–1908	1899–1900	1889–1890	1879–1880	1869–1870
Theology	10,218	9,583	8,009	7,013	5,242	3,254
Law	18,553	18,069	12,516	4,518	3,134	1,653
Medicine (incl. homeopathic)	22,158	22,787	25,213	15,484	11,929	6,194

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SCIENTIFIC NOTES AND NEWS

Dr. H. T. Ricketts, of the University of Chicago, who has been in Mexico conducting research into the etiology of typhus fever, has died from that disease.

Dr. John Trowbridge, who retires this year from the active duties of his chair at Harvard University, has been appointed honorary director of the Jefferson Physical Laboratory.

Dr. Abraham Jacobi, emeritus professor of the diseases of children in the College of Physicians and Surgeons of Columbia University, celebrates his eightieth birthday on May 6. On April 23, exercises were held at the Mount Sinai Hospital in his honor. A bronze bust was presented to the hospital by the medical and surgical staff, and a new library named in his honor was given by the board of directors. At a dinner given the same evening by the trustees of the German Hospital announcement was made that the new children's ward which Mrs. Anna Woerishoffer has given to the hospital will be known as "The Dr. Abraham Jacobi Division for Children."

Sir Archibald Geikie has been elected a foreign member of the Royal Danish Society of Sciences, Copenhagen.

Sir Thomas Barlow has been elected president of the Royal College of Physicians, London, in succession to Sir Douglas Powell.

Professor R. B. Owens, recently professor of electrical engineering in McGill University, has been appointed secretary of the Franklin Institute, Philadelphia.

MR. H. C. GRAHAM, B.A., Toronto, '08, and fellow in chemistry, has been appointed chemist assistant in the Provincial Laboratory at Edmonton, Alberta.

MR. J. E. SEARS has been appointed to take charge of the work of the metrology division of the British National Physical Laboratory in the place of Mr. H. Homan Jeffcott, who has been nominated recently to the professorship of engineering in the Royal College of Science, Dublin.

MRS. ZELIA NUTTALL has handed in her resignation as member of the Organizing Committee of the Seventeenth International Congress of Americanists, to be held in Mexico City next September, and has also renounced the title of honorary professor of Mexican Archeology at the National Museum, as a protest against the treatment she received from the ministry of public instruction and the inspector of monuments in connection with her recent discovery and proposed exploration of the ruin of an ancient temple on the island of Sacrificios, off Vera Cruz.

THE American Philosophical Society in response to invitations received has appointed the following delegates to represent it at the International Congresses to be held during the current year. At the International Botanical Congress to be held at Brussels, May 14–21, 1910, Professor George Lincoln Goodale, of Harvard University. At the International Scientific Congress to be held at Buenos Aires, July 10–25, 1910, Dr. Louis A. Bauer, director of the department of Terrestrial Magnetism, Carnegie Institution, Washington. At the International Geological Congress to be held in Stockholm, August 18–25, 1910, Professor Harry C. Jones, of Johns Hopkins University. At the Congress of Americanists to be held in the City of Mexico, in September, 1910, Professor Frederick W. Putnam, of Harvard University.

DIRECTOR L. H. BAILEY, of the College of Agriculture of Cornell University, is at present in Great Britain.

THE American Electrochemical Society is holding this week its seventeenth general meeting at Pittsburgh. The address of the president, Dr. Leo H. Baekeland, is on "Science and Industry."

AT the annual meeting of the Iron and Steel Institute, May 4 and 5, Sir Hugh Bell resigned the chair to the Duke of Devonshire. The Bessemer gold medal for 1910 was presented to Mr. E. H. Saniter, and the president delivered his inaugural address.

DR. L. A. BAUER gave the following lectures on terrestrial magnetism and atmospheric electricity at the Johns Hopkins University from April 25 to 29:

"The Chief Facts of the Earth's Magnetic Changes (Regular Variations and Magnetic Storms)."

"The Ionic Theory of the Earth's Magnetic Disturbances."

"The Earth's Magnetic Permeability and General Theory of Magnetic Variations."

"Relation between Terrestrial Magnetism, Solar Activity, Atmospheric Electricity, Radioactivity, Meteorology and Geology."

Nature quoting from the *Daily Chronicle* states that a monument in memory of Professor Tyndall will be erected on the summit of the Bel Alp, 6,735 feet high, a little above the place where for many years Tyndall resided during the summer months. Mrs. Tyndall has engaged M. F. Correvon, of Geneva, to design the monument, which is a large conical block of granite. It will be erected by the Swiss Alpine Club in July on Bel Alp, overlooking the Aletsch Glacier.

WE learn from the *Journal* of the American Medical Association that at Jefferson, Ga., on April 21, a monument to Dr. Crawford W. Long was unveiled in the presence of members of the Medical Association of Georgia, which was in session at Athens. The monument is in commemoration of the fact that Dr. Long was one of the first to use ether as a general anesthetic. Dr. Woods Hutchinson, of New York, was the principal speaker.

THE death is announced of Dr. George Carpenter, editor of the British journal of chil-

dren's diseases and a well-known authority on this subject.

The Congress of American Physicians and Surgeons is meeting in Washington this week. Meeting in affiliation with it are the American Association of Genito-Urinary Surgeons, American Association of Pathologists and Bacteriologists, American Climatological Association, American Dermatological Association, American Gynecological Society, American Laryngological Association, American Medico-Psychological Association, American Neurological Association, American Ophthalmological Society, American Orthopedic Association, American Otological Society, American Pediatric Society, Association of American Physicians, and American Surgical Association.

The British *Medical Journal* states that Professor Lannelongue, of Paris, has written to the Société de Chirurgie announcing his intention of founding a prize consisting of a gold medal carrying with it a sum of £250, to be awarded to the candidate who has contributed most to the progress of surgery during the ten years before the date of award. The prize is open to surgeons of all nations, and will be awarded every five years during the annual meeting of the Paris Société de Chirurgie. The judges will be a committee of surgeons of various nationalities, grouped as follows: The United Kingdom; Germany; Austria-Hungary and the Balkan States; Belgium, Holland and Scandinavia; Spain, Portugal and Mexico; United States and Canada; South America; Japan and China.

The Naples Table Association for Promoting Laboratory Research by Women announces the offer of a fifth prize of one thousand dollars for the best thesis written by a woman, on a scientific subject, embodying new observations and new conclusions based on an independent laboratory research in biological, chemical or physical science. The theses offered in competition are to be presented to the executive committee of the association and must be in the hands of Mrs. Ellen H. Richards, Massachusetts Institute of Technology, Boston, Mass., before February 25, 1911. The papers will be judged by a board of examiners, or by such specialists as they may choose. The Board of Examiners consists of Dr. William H. Howell, Dr. Theodore W. Richards and Dr. Albert A. Michelson. The first prize was awarded to Florence Sabin, B.S., Smith, '93, M.D., Johns Hopkins University, '00, for a thesis on the "Origin of the Lymphatic System." The second prize was awarded to Nettie M. Stevens, B.A., M.A., Leland Stanford University, '99, '00, Ph.D., Bryn Mawr, '03, for a thesis on a "Study of the Germ Cells of *Aphis rosea* and of *Aphis œnotheræ*." The third prize offered was not awarded. The fourth prize was awarded to Florence Buchanan, D.Sc., Fellow of University College, London, for a thesis on the "Time Taken in the Transmission of Reflex Impulses in the Spinal Cord of the Frog."

A letter has been received at the Harvard College Observatory from Professor Robert W. Willson, of Harvard University, stating that Halley's comet was photographed by Dr. J. C. Duncan at the Students' Astronomical Laboratory of Harvard University, April 21^d 3^h 51^m A.M. eastern standard time. "Exposure 15m., considerably fogged by dawn. Comet brighter, photographically, than B.D. +6″.5227, mag. 4.4. Tail faintly seen to a distance of one degree; leaves read between two short, well-defined streamers whose position angles are 66 and 142 degrees. Pos. Ang. of axis of main tail, 100 degrees." A photometric measurement of the light of the nucleus of Halley's comet was made by Professor Wendell at the Harvard College Observatory on April 27. The comparison star was B.D. +7″.5101, phot. magn. 6.74. The measured brightness of the nucleus was 6.01 magn. The comet was visible to the naked eye. Its total brightness was estimated as 3.0 magn., or brighter, and the tail as over 3° long. The comet was observed visually on April 27 by Mr. Leon Campbell, who saw it easily with the naked eye and estimated its total brightness, by the Argelander method, as 2.5 magn. He estimated the tail as 4° in length. A photograph of the comet was ob-

tained at the observatory on the same morning. On the photographic plate, the comet shows a rather sharp nucleus with a short tail.

AN excursion for geological and geographical field work was recently made to the district between the Hudson River and the Catskill Mountains, with headquarters at Catskill, N. Y., by a party of thirty teachers and students from Harvard, the Massachusetts Institute of Technology, Yale, Columbia, St. Lawrence and Rutgers. The district visited is of particular value from its succession of fossiliferous formations, its folded and faulted structure, and its characteristic Appalachian topography, both structure and form being developed on a small scale that is especially suitable for purposes of instruction. Among the instructors present were Professors Davis and Johnson and Mr. Lahee, of Harvard; Professor Shimer, of the Massachusetts Institute of Technology; Professor Chadwick, of St. Lawrence; Mr. Hyde, of Columbia, and Professor Lewis, of Rutgers. Detachments of the party, first led by Professor Chadwick and later led by Professor Johnson, ascended the strong east-facing escarpment of the Catskill mountains, with special attention to the features of stream capture as determined by the retrogressive erosion of the east-flowing Kaaterskill Creek in its deeply incised clove, under the broad high-standing valley of the west-flowing Schoharie Creek.

THE commission on phytogeographic nomenclature appointed by the second International Botanic Congress, held in Vienna in 1905, and of which Professor John W. Harshberger, of the University of Pennsylvania, is the American member, has printed its report in a pamphlet of forty pages. This report is the joint work of Briquet, Geneva; Adamovic, Vienna; Beck von Mannagetta, Prague; Drude, Dresden; A. Engler, Berlin; Flahault, Montpellier; Harshberger, Philadelphia; C. Schröter, Zurich; W. G. Smith, Edinburgh; Warburg, Berlin; Eug. Warming, Copenhagen; and it will be presented with recommendations to the third International Botanic Congress, to be held in Brussels, from May 14 to 22, 1910.

THE American Phytopathological Society has passed resolutions as follows:

Resolved, That the American Phytopathological Society views with alarm the recent introduction into America of two dangerous European plant diseases: the potato wart, caused by *Chrysophlyotis endobiotica* Schilb., and the blister rust of white pine, caused by *Peridermium strobi* Klebahn. The former has been discovered in New Foundland. The latter has been widely distributed in nine of the United States and in the Province of Ontario, but is now believed to have been eradicated.

Resolved, That the society deplores the fact that in the absence of any national regulation in either the United States or Canada both governments are powerless to prevent the continued introduction of these and other dangerous diseases, or their transference from one country to the other.

Resolved, That on account of the enormous financial interests involved in potato culture and in white pine reforestation, this society regards the situation as very alarming, and one which warrants radical and immediate action. Even if these diseases do no more harm in America than they have in Europe, the situation is serious; but every law of biology and all experiences with plant diseases and pests indicates that, in a new climate, with new varietal and specific hosts and with an entire continent in which to spread, both diseases will reach a degree of virulence unknown in Europe.

Therefore, *Resolved,* That this society pledges its support to all legislation in both the United States and Canada looking toward the inspection, quarantine, or prohibition from entry, as may be necessary, of all plant material liable to introduce these or other dangerous diseases or pests.

SOME facts are being brought out by investigations of the effect of high voltages on insulating material by Mr. H. S. Osborne who is carrying out work for the degree of doctor of engineering at the Massachusetts Institute of Technology. At a recent meeting of the Boston Section of the American Institute of Electrical Engineers, which was held at the electrical engineering laboratories of the Institute of Technology, Mr. Osborne lectured on the results of his experimental research. The lectures of Professor Harold Pender for graduate students will next year extend the

discussion contained in his advanced lectures of this year on the high voltage alternating transmission and utilization of power. Professor Jackson's lectures for graduate students on the organization and administration of public service companies have this year dealt more particularly with questions of value of plant, the theory of so-called intangible values, the relation of revenues to value of the plant, depreciation, and the like; and next year the lectures will be directed more to the theory underlying methods of charging for service by public service companies, with particular reference to charges for electric light and power, but with collateral consideration of railroad and tramway charges and charges for gas and the service of other public utilities. Professor Wickenden will give a course of lectures on illumination, photometry and illuminating engineering which will become a part of the optional curriculum for undergraduate and graduate students.

Mr. L. L. Hutchison, assistant director of the Oklahoma Geological Survey, has sent to press a special state report on the asphalt, oil and gas deposits of Oklahoma. In part one is a general map which shows that portion of the state in which asphalt occurs and the region where it is likely to be found. It also contains a geological map of the asphalt bearing district, and one showing the exact location of nearly one hundred known deposits. Part two is devoted to oil and gas. After reviewing the history of the industry and discussing the various theories of origin and accumulation of petroleum and natural gas, Mr. Hutchison discusses the geology of the Oklahoma petroleum and natural gas fields and closes the work with a chapter devoted to the latest Oklahoma statistics and a review of past and present conditions in the field. This section of the report is illustrated by a general map showing the present developed areas, probable territory yet undeveloped, and those parts of the state where it seems possible that oil and gas may be found and by a geological map of the oil fields and detailed maps, on a scale of one inch to the mile, which give the location of every well drilled in the various important fields prior to 1910.

The Connecticut Agricultural College and the Willimantic State Normal School will hold their summer schools in the buildings of the State Agricultural College at Storrs, Conn., July 5–July 29, 1910. The Agricultural College offers courses in bird and insect study, botany, dairy industry, animal husbandry, school gardening, fruit culture, floriculture, landscape gardening, soils, farm crops, practical cooking, a special four-weeks' course in practical poultry husbandry, and a course in elementary agriculture with a model country school showing how agriculture may actually be taught in the schools. The Normal School offers courses for teachers in arithmetic, civics, geography, history, language, methods in rural schools, penmanship, psychology and reading.

Professor J. W. H. Trail, F.R.S., recently offered to the council of the Linnean Society a sum of money for the purpose of encouraging the study of protoplasm by means of an award to be made periodically, and, as we learn from *Nature*, a special medal has been struck in bronze for presentation with the award, bearing on the obverse a portrait of Linnæus and on the reverse the words "Trail Award" and the name of the recipient in a wreath. It is proposed to make an award about once in every five years for original work bearing directly or indirectly upon the "physical basis of life," and, in accordance with the wishes of the donor, a wide interpretation will be given to the scope of the investigations. The first recipient of the award will be Professor E. A. Minchin, professor of protozoology in the University of London, whose researches on sponges and protozoa have done so much to advance our knowledge of protoplasmic structures, and who is also the translator of Professor Bütschli's well-known work on protoplasm.

UNIVERSITY AND EDUCATIONAL NEWS

More than $2,000,000 has been contributed to Washington University, St. Louis, for the medical department. The donors are Messrs. William K. Bixby, Adolphus Busch, Edward Mallinkrodt and Robert S. Brookings. Added to this are the resources of Barnes

University, recently absorbed; the Martha Parsons Hospital and the original endowment fund of the university. New appointments have been announced as follows: Dr. George Dock, of Tulane University; Dr. John Howland, of the University and Bellevue Hospital Medical College; Dr. Eugene L. Opie, of the Rockefeller Institute for Medical Research, and Dr. Joseph Erlanger, of the University of Wisconsin. Construction of new buildings, to cost more than $1,000,000, will begin at once.

BY the will of Stanley O. Thomas, recently probated, Tulane University received a legacy of $60,000, to be used for the erection of a building.

MR. R. A. BOOTH will give the Williamette University, of Salem, Ore., $100,000 as an endowment fund on the condition that the institution raises $300,000 more from other sources.

ACTING upon the suggestion of representatives of the Carnegie Foundation, plans are being completed to merge the medical school of Ohio Wesleyan University with that of Western Reserve University, both of which are located in Cleveland. The students and part of the faculty of the College of Physicians and Surgeons will by this consolidation be transferred to the Western Reserve Medical School, while Ohio Wesleyan University, of which the College of Physicians and Surgeons now is a department, will sever all connections with the Cleveland school.

AT the annual business meeting of the board of regents of the University of Wisconsin Eric W. Miller, of the U. S. Weather Bureau station at Madison, was made lecturer in meteorology; Professor J. D. Phillips, of the engineering drawing department, was made assistant dean of the college of engineering; Max Mason was promoted to be professor of mathematical physics from an associate professorship of mathematics. The following were promoted from assistant professor to associate professor: E. B. Skinner, in mathematical physics; L. R. Ingersoll, in physics; E. V. McCollum, in agricultural chemistry, and J. G. Moore, in horticulture. Promotions from the instructor to assistant professor were made as follows: C. A. Fuller, in bacteriology; W. J. Mead, in geology; H. C. Wolff, in mathematics; W. H. Brown, in pathology; E. M. Terry, in physics; W. J. Meek, in physiology; W. E. Tottingham, in agricultural chemistry; E. J. Dolwiche and A. L. Stone, in agronomy; G. H. Benkendorf, in dairy husbandry, and J. H. Price, in electrical engineering.

AT Columbia University Dr. Edward Kasner has been promoted to a professorship of mathematics, Dr. Russell-Burton Opitz, to be associate professor of physiology and Dr. Raymond C. Osburne to be assistant professor of zoology in Barnard College.

DR. R. DEC. WARD has been promoted to a chair of climatology at Harvard University.

RECENT additions to the faculty of the University of North Dakota are George Alonzo Abbott, Ph.D. (Massachusetts Institute of Technology), professor of chemistry, and Bartholomew J. Spence, Ph.D. (Princeton), assistant professor of physics.

MR. J. A. SMITH has been elected to the Waynflete chair of moral and metaphysical philosophy in the University of Oxford, to fill the vacancy caused by the resignation of Professor T. Case.

DISCUSSION AND CORRESPONDENCE

THE UNIVERSITY OF MINNESOTA AND THE CARNEGIE FOUNDATION

TO THE EDITOR OF SCIENCE: The following report from the *Minneapolis Journal* of speeches made after a dinner of the Faculty Club of the University of Minnesota has been corrected by the speakers and is forwarded to SCIENCE for publication. The resolutions referred to have been prepared by the executive committee and forwarded to the trustees of the foundation. X.

UNIVERSITY OF MINNESOTA,
April 29, 1910

Decided protest against the action of the trustees of the Carnegie Foundation in substituting complete disability for the twenty-

five-year service period was made by the members of the Faculty Club of the University of Minnesota at its dinner last night. After a series of spirited talks the executive committee was requested by formal motion to prepare resolutions expressing the sentiments of the club and to forward them to the trustees.

Professor John J. Flather, head of the mechanical engineering department, who presided at the dinner, opened the discussion with a brief but complete history of the establishment of the Carnegie Foundation for the Advancement of Teaching.

Mr. Flather devoted much of his address to the clause which grants a pension to professors in accepted institutions who have had a service of twenty-five years. This rule has been so changed that it will only apply to those who are unable to continue their work through disability.

Mr. Flather said on this point: "Surely, there is no justification for the statement that it was believed that the number of teachers who would avail themselves of retirement under the service provision would be confined almost exclusively to those physically impaired.

"Under the provisions of the foundation a teacher, after twenty-five years of service as a professor, was certainly entitled to retire without having his motives questioned. The recent action of the board is an unjust reflection upon every professor who has accepted the benefits of the foundation under the service requirements, and in consequence will be resented by every fair-minded person.

"If the Carnegie Foundation is to advance the cause of education in what better way can the funds be used than to retire certain teachers after long and meritorious service? If a man has lost interest or is worn out by the many demands upon his energies after a service of thirty to thirty-five years, why is it not wise to retire him after such service instead of waiting until he breaks down altogether, or until he reaches the age of 65 years. Most men will desire to teach until the age limit is reached. Why not, therefore, allow the lesser number to retire if thereby the cause of education will be advanced?

In order to ascertain why college teachers retire Dr. Pritchett sent letters to all teachers on the retired list. From those who had retired below the age of 65, after twenty-five years' service in the grade of professor, forty-two letters were received. Of these twelve had retired on the ground of impaired health; ten retired on account of some college complication, the resignation of one half of the number having been requested. Of the remaining twenty, five desired to engage in research or other professional labor, two took advantage for family reasons; two thought that younger colleagues ought to have the chance to occupy the position they held; five desired to engage in business; six desired recreation and relief from the recitation and lecture room.

The average length of service of all the men from accepted institutions who have been retired to date is practically thirty-five years, and the average age at retirement 60 years.

The rules amended by the board of trustees in accordance with the recommendations of its president, provide a retiring allowance for a teacher on two distinct grounds: (1) to a teacher of specified service on reaching the age of 65; (2) to a professor after twenty-five years of service in case of physical disability, or thirty years as professor and instructor together.

"Although these are the general rules governing retirement, the trustees are nevertheless willing to grant a retiring allowance after the years of service set forth in Rule 1 to the rare professor whose ability for research promises a fruitful contribution to the advancement of knowledge if he were able to devote his entire time to study or research; and the trustees may also grant a retiring allowance after the years of service set forth in Rule 1 to the executive head of an institution who has displayed distinguished ability as a teacher and educational administrator.

"There seems nothing incompatible with the dignity and right of a teacher in retiring for the reasons above assigned. The foundation is not a charity; the retiring allowance is a part of the regular academic compensation and if there is any merit in the service pen-

sion it should not be dependent upon the disability of a professor, nor contingent upon his ability or willingness to become the head of an institution.

"The action of the board in peremptorily abrogating one of the two specific objects of the foundation, is justly looked upon with great disfavor by a large body of men engaged in college teaching, nor can it be justified by the arguments advanced. The system has not been working a sufficient length of time to frame accurate conclusions or to draw inferences which would warrant such drastic measures."

Professor Henry J. Fletcher, of the law school, in discussing the legal aspects of the situation, spoke as follows:

"The Carnegie Foundation is now organized under an act of Congress. It is the trustee of an express trust. It holds a fund the income of which is to be distributed among beneficiaries. These beneficiaries were not named by the founder, but the 25 men selected as trustees (who have now incorporated themselves) were authorized to designate beneficiaries. They have done this, not by name, but by defining classes of persons. When trustees, in addition to their ordinary duties as trustees, are empowered to name the beneficiaries of a trust which they are to administer, and they do name them, a named beneficiary becomes the owner of a definite enforceable, equitable interest in the fund. This equitable interest, so fixed, is vested; it is property; it can not be destroyed by a revocation of the designation, either by the action of the trustee alone, or by the trustee and founder acting together, unless the right of revocation has been reserved. If acting under the authority of the deed of trust, the trustees, instead of naming beneficiaries, define a class, all of whose members are declared to be entitled to participate in the fund as beneficiaries, each individual member of the class has exactly the same rights as if he had been named.

"As I understand the facts, the trustees of the Carnegie Foundation defined two classes: First, those professors in accepted institutions who should have served 25 years—service already performed to count toward the period designated; second, those professors in accepted institutions who should continue in the service until they reach the age of 65 years. If the principles outlined above are correctly stated, professors belonging to the first class who at the time of the announcement were engaged in the designated class of work in accepted institutions, and were therefore eligible to a pension on completing the required period of service, have a vested property interest in the fund, subject to be defeated only by their failure to remain in the class for the requisite length of time. For example, if a professor were designated by name, and informed that he was eligible to the service pension on condition that he continue in service until he shall have taught 25 years, his rights would thereby become vested. If, instead of being named, he were a member of the first class, the case would be the same. His rights could no more be destroyed without his consent than the rights of the beneficiary under a life insurance policy can be cut off without his consent prior to the death of the life-insured. If the trustees have the power to annex new conditions to the receipt of a pension by members of the first class, they can cancel the designation of that class entirely; and if they can drop the first class, they can drop the second as well; they can abandon the present plan and adopt a new one, with wholly different beneficiaries.

"The only theory under which the trustees can claim a legal right to change beneficiaries at pleasure is, that the trust is a charity, or that the right to change has been expressly reserved. A charitable trust does not require, nor permit, definite beneficiaries. No individual can claim the enforcement of a charity in his behalf. But the trustees of the Carnegie Foundation have taken especial pains to make it certain that this is not a charitable trust. They have declared that the pensions to be paid are payments for services rendered, to which the recipients are to be entitled as of right, and not as a charity. If that is true, any man who entered the class before the trustees declared their intention to practically

abolish it, has rights enforceable in a court of equity. Were it not for repeated declarations of the trustees to the contrary, I should be strongly disposed to think the trust charitable. The courts would of course not be bound to adopt the view of its character now taken by the trustees, and the trustees may hereafter themselves think differently. Their recent change of attitude suggests that possibility. If unforeseen exigencies should compel them to take the position that the trust is after all in the nature of alms, very likely the courts would sustain them. A recipient of charity takes what he can get, not by right, but by grace.

"I assume, then, that the trust is non-charitable. It is true the trustees reserved the right to change their rules governing the details of administration; but obviously that has no reference to the abolition of a class already designated, so as to destroy vested interests. The articles of incorporation empower the trustees 'from time to time to modify the conditions and regulations under which the work shall be carried on,' and, by a two-thirds vote, to 'enlarge or vary the purposes' of the gift. This no doubt permits the door of entrance into either class to be closed at the discretion of the trustees; such action operates prospectively; but it is seriously doubted that the trustees by this clause reserve the power to cut off persons who are already in, and this includes all teachers and others of professorial rank who prior to the date of change in rule two were employed in accepted institutions."

Dean George F. James, of the College of Education, continued the discussion somewhat as follows:

"All of us remember with what pleasure we heard of Mr. Carnegie's gift for the advancement of university teaching. The general plan seemed to hold large promise for the improvement of higher institutions through better provisions for the teaching force. When the trustees later announced their plans in detail, the establishment of a service pension appeared from many points of view even more important than the accompanying arrangement of a retiring annuity at the age of sixty-five. As the trustees went on with their work and issued one report after another, proving the gradual acceptance by our colleges and universities of a uniform standard of entrance requirements and a minimum requirement in equipment, productive funds, and other conditions of efficiency, we became each year more convinced of the broad usefulness of the foundation.

"When the trustees suddenly disavowed one of the two main principles first adopted in respect to pensions, the announcement came as a distinct shock, not merely on account of the direct and immediate consequences, but even more on account of the uncertainty which might attach itself to the whole scheme of the foundation owing to this radical change of policy. The trustees had themselves on many occasions implied that of the pension system inaugurated by the foundation, the two best characteristics were the implicit confidence which beneficiaries might put in the consistent execution of the plans adopted, and the sense of right rather than favor which would be associated with each annuity granted. The first characteristic is largely eliminated by the sacrifice by the foundation of one important principle without any convincing statement as to either the advisability or the necessity of the action. The second characteristic on which the trustees have laid much stress can hardly be preserved, and professors in accepted institutions can hardly look upon the pension as a right rather than a charity, in view of the very serious strictures made by the president in the last annual report on a majority of the men who have so far retired on a service pension. The impersonal relationship which the trustees so properly emphasized as desirable between the foundation and the men retired under its provisions is thus very suddenly and vitally modified, with a resulting imminent danger that the attitude of university teachers the country over toward the foundation may no longer be as cordially sympathetic as hitherto.

"The problem of age and service pensions

under the foundation is sufficiently large and weighty so that no extraneous question should be brought into this discussion, but most of you must have observed with considerable interest, if not apprehension, the view adopted by a sister state in respect to private benefactions and the resulting indirect private control over public institutions. The plans of the Carnegie Foundation have commended themselves to us all, and the mode of procedure under these plans has, up to the present, been susceptible of no serious objection from the institutions which are cooperating or from the general public. Nevertheless, a very large element in public opinion is doubtful of the desirability of subjecting public education to any form of corporate influence which is not itself responsive to public opinion. Lest this feeling should grow so as to jeopardize the usefulness not only of this but of many instances of private benefaction, the trustees of the Carnegie Foundation, in the judgment of many disinterested and sympathetic observers, should be very much on their guard against any apparent transcendence of their real functions. In a recent report of the foundation a proof may be found of the delicate nature of the ground on which the foundation is treading in its official publications. Broad questions of educational administration must be to some extent raised and discussed in connection with the immediate problems of the foundation itself, but that a decided attitude should be taken by its officers as regards a problem not vital to its purposes, as was done recently in the matter of federal appropriations to education, will seem to many an act of doubtful propriety, and likely to arouse criticism otherwise unnecessary, if not to bring about an attitude of real hostility on the part of the public toward the work of the foundation.

"In the situation which now presents itself, the trustees of the Carnegie Foundation will certainly welcome an expression of opinion from all of the accepted institutions cooperating in its work, and therefore a motion is herewith made that the executive committee of this organization, representing the different faculties of the University of Minnesota, be directed to submit to the executive committee of the Carnegie Foundation for the Advancement of Teaching that the service pension as originally planned and put into effect was one of the most admirable features among the many projected by the foundation; that the limitation now imposed is a serious impairment of its scope and nullifies very largely the beneficent object contemplated; that we sincerely regret the action of the trustees in their announcement of the practical withdrawal of such pension; that we deplore the lack of confidence which has resulted therefrom; and that in our opinion the service pension should be restored in a form not essentially different from its original."

In conformity with the above mentioned the executive committee will draw up a set of resolutions and forward the same to the trustees of the Carnegie Foundation at an early date.

SCIENTIFIC BOOKS

Précis d'Embryologie Humaine. Par F. TOURNEUX. Second edition. Pp. 589, 248 figures. Paris, 1909.

This work, like McMurrich's "The Development of the Human Body," is a text-book for the student of medicine. The two books have the same general character, being brief, concise and accurate statements of the outlines of human embryology. They are of almost the same size for, although the pages of the latter are somewhat larger, the smaller type of the former allows a greater compactness.

Tourneux has dispensed entirely with a bibliography, but has more than compensated for its absence by an historical treatment of the subject. Throughout the book he credits to each author, by putting his name and the date of the work in parentheses, his particular contribution to the subject. In this way the author succeeds admirably in giving the student an insight into the history of embryological research and in preventing him from feeling that the book is an ultimate authority.

The book begins with an introduction upon the history of embryology which the author divides into three periods: morphological, his-

tological and phylogenetic. He believes that the last period extends to the present time, but to the writer the interest in theories of vertebrate descent, and the belief that the "law of von Baer" can yield a fundamental conception of the history of animal forms, seem to have given place to the desire to understand the principles of growth and of inheritance.

The first chapter, upon the germ-cells, maturation, fertilization and segmentation, is of a general and comparative nature and includes an exposition of the theories of the significance of maturation and fertilization, and of the problem of heredity. It does not contain, however, any reference to Mendel's work or to that of his successors.

In order to have a consistent and continuous description of the early stages of development, Tourneux devotes a long chapter—slightly more than one sixth of the text proper—to a description of the history of the ovum of the rabbit up to the time of the establishment of the body-form. This account is very clear and convincing, and is particularly acceptable because the author does not interrupt its continuity by making a patch-work of fragments of the history of the ova of many vertebrates.

The third chapter, which completes the first part of the book, contains brief accounts of many of the best preserved early human embryos.

The second part of the book is divided into thirteen chapters, which may be subdivided according to size into three groups: those upon the digestive and urogenital systems are long, having 79 and 74 pages, respectively; those upon the nervous, locomotor and circulatory systems, and the fœtal envelopes are of moderate length, about 40 pages; and finally, those upon the respiratory system, suprarenal organs, the skin and upon the organs of taste, smell, sight and hearing are short. The treatment of the digestive and urogenital systems seems disproportionately long, and the section upon the voluntary muscles, consisting of about thirty lines in the chapter on the locomotor system, is ridiculously small. Otherwise the discussion of the several organs and organ systems is excellently proportioned. There is an index and an appendix upon the length of the period of incubation or of gestation in several birds and mammals.

The failure to adopt the Basle anatomical nomenclature, and even the occasional omission, in an extensive series of synonyms, of the name used in this nomenclature, seem to the writer to be the great fault of the book.

The figures, 248 in number, are well chosen and are excellently reproduced. The use of only a very few diagrams is commendable. The book deserves a thorough success.

Leonard W. Williams

Broad Lines in Science Teaching. By F. Hodson. New York, Macmillan Co. 1910. 8vo, pp. xxxvi + 267. $1.25.

This book consists of a series of essays by a number of writers, edited by Mr. F. Hodson, of the Bedales School at Petersfield, England. The papers all deal with the teaching of science to boys and girls of secondary school age; and the editor's object has been "to cover a wide field, to achieve, through variety of the contributor's experience, a variety of presentation, and so to convince the reader of the many-sided human value of science in modern education."

The introduction is by Professor M. E. Sadler, who calls attention to the necessity for a more careful study of the methods of teaching science. He says (p. xix):

> Science has secured a place in the curricula of the higher schools, a firm place and respectful recognition; but scientific method and the spirit of science have not yet influenced the whole of the intellectual life of the schools, have not yet remolded the ways of teaching in other than what, in the narrower sense of the words, are called scientific subjects.

He then reviews the essays that follow, and draws some general conclusions from the study of the entire collection. As distinct marks of successful teaching of science he mentions four as being most essential—an alert interest in things seen; patience and exactitude in observing, verifying and recording them; a disposition to brood over new

facts before reaching a judgment as to their meaning and classification, and an habitual willingness to take great trouble in getting at the truth.

The first essay is by Professor J. H. Badley on the Place of Science in the School Curriculum. He tests the value of science in education by "the kind of motive it appeals to and arouses, the kind of power it develops, and the kind of discipline it gives." He shows that, tested by these criteria, science has an important place in the schools.

The remaining essays in the book are as follows: The Scope of Nature Study, Edward Thomas; The Teaching of Nature Study, Clotilde Von Wyss; Biology in Schools, Oswald Latter; The Teaching of Hygiene, Alice Ravenhill; The Place of Hypotheses in Science Teaching, T. Percy Nunn; The Claims of "Research" Work and Examinations, Fred Hodson; School Mathematics in Relation to School Science, T. James Garstang; Coordination of Physics Teaching in School and College with Special Reference to Electricity and Magnetism, Alfred W. Porter; Geography, J. H. N. Stephenson; Science in the Teaching of History, F. M. Powicke; Economic Science in Secondary Schools, Augustus Kahn; Domestic Science, Arthur Smithells; The Teaching of Chemistry in Technical Schools, Henry Garrett; How the School may help Agriculture, E. W. Read; Engineering, An Associate of the Institution of Civil Engineers—Science Teaching and the Training of the Affections, Sidney Unwin; Science Teaching and a Child's Philosophy, Cora B. Sanders; The Present Condition of Physics Teaching in the United States, C. R. Mann; School Science in Germany, the Editor; Some Practical Notes on the Planning of Science Laboratories, T. H. Russell.

In the brief space of a review it is impossible to give any definite idea of the content and richness of these essays. They are all excellent and full of suggestion. Every one who is interested in the problems of science teaching on broad lines should read and study this book at first hand. It is an important contribution to one of the most pressing of our school problems of the present day.

C. R. MANN

THE UNIVERSITY OF CHICAGO

Design in Nature. By J. BELL PETTIGREW, M.D., F.R.S., 3 vols. New York, Longmans, Green & Co. 1908.

Dr. J. Bell Pettigrew, professor of anatomy and medicine in the University of St. Andrews, was more especially known for his contributions to mammalian anatomy and discussions on the physiology and mechanics of flight. He was not a skilled zoologist, in the sense of being an expert student of any particular group of animals; but he had a keen interest in nature and a wide, if somewhat shallow, knowledge of a great variety of subjects. Being firmly convinced that the order and beauty of the visible world bore eloquent testimony to the existence of an invisible but ever-present "creator, designer and upholder," he conceived the idea of preparing a work which should make this evident to every reader. The "argument for design" presented nothing new, of course; but never before had it been supported by such a wealth of illustrative facts, gleaned from the storehouses of modern science. Just as Darwin profited by the mass of data accumulated by those who knew nothing of evolution, now Pettigrew was to utilize the contributions of an unbelieving age, in support of the ancient doctrine of special creation. The work was finished, and partly printed, at the time of the author's death in January, 1908. It consists of three great quarto volumes, aggregating 1,416 pages, with innumerable illustrations. The printing and binding are excellent, and at the beginning of each volume is a portrait of the author. As is remarked in the preface, "it was necessary to deal with physics, chemistry, botany, zoology, anatomy, physiology, psychology and paleontology more or less in detail," but most space is given to the author's favorite subjects, vertebrate anatomy and animal locomotion. Those who have no sympathy with the main purpose of the work will find it a sort of glorified scientific scrap-book, full of entertaining and instructive matter. It does not

contain a closely reasoned philosophical argument, but naïvely assumes that there can be only one logical explanation of the facts presented, and consequently the case becomes stronger in proportion to the data accumulated. This is of course the attitude of the modern evolutionist, only his explanation is not quite the same. The wonders of adaptation, the community of general structure in series of animals, the facts of paleontology, all are brought forward as evidence of intelligent design. If two pictures or statues show points of resemblance we do not say that they are derived one from the other, but we may suspect that they were created by the same hand. Just so Dr. Pettigrew, and having got thus far, the very difficulties in the way of the creation hypothesis appear to lend it support. For example, take any remarkable case of adaptation; the naturalist may show that a particular species is able to flourish at a particular time and place, because of a multitude of circumstances, *all* of which are more or less essential to its prosperity. It would not be sufficient merely to create the animal, it must be exactly so, at exactly such a place, with all the other characters in the play doing their proper parts. Quite impossible! you say. On the contrary, it is such a marvelous thing that it *proves* the action not merely of intelligence, but of the highest conceivable kind! The trouble is, that it not only requires the highest conceivable intelligence, but a still higher and wholly *inconceivable* sort. It transcends physics and metaphysics, and lands us in the field of metapsychics. In other words, the "explanation" is no explanation at all, and serves merely to shelve the question of origin and sequence. The author, at the end of each discussion, turns around to his audience and asks, like the conjurer, who can explain the trick except in his way; but also like the conjurer, he refrains from telling us precisely what that way is. There is no reason to suppose that this ardent supporter of "creation" had or pretended to have the least idea of the nature of the process.

Although our criticism is adverse, we must confess to a certain sympathy with the author. Evolution is not a key to unlock every door of mystery. We who are concerned daily with the mechanics of life need to be reminded from time to time that there are more dimensions of reality than those in which we quarry. It is not for us to claim that we really understand, in any complete sense, how this world of ours came to be what it is. As scientific men, however, we are bound to reject mere dummy explanations of things, mere words which embody no rational thought; and by the same token, we must hold fast to those facts and theories which seem to be best verified by experience. The theory of organic evolution, full of difficulties as it is, has some substance, some genuine pragmatic ability; that of creation, as held by Dr. Pettigrew, is but a shadow of a shadow. To our posterity five hundred years hence it will doubtless seem that we were groping in the dark; but let it be at least said of us, that we groped to the best of our ability.

T. D. A. Cockerell

Bulletin of the American Museum of Natural History, Vol. XXVI.

This volume of contributions from the scientific staff of the American Museum of Natural History appears less interesting than its predecessor, though it attains a generous size of 430 pages, and contains twenty-nine articles from the pens of seventeen contributors. The articles of discussional and narrative value are fewer in number, and the volume is more confined to systematic studies.

Perhaps, from the point of view of general utility and interest, Mr. A. Hermann's demonstration of "Modern Laboratory Methods in Vertebrate Paleontology" most quickly attracts attention. The article can not be impugned on the score of paucity of detail. It makes indeed an excellent manual of direction for all museums of vertebrate fossils, and commands deference from the place its author holds among preparators. It is also in a measure, and quite frankly, a history of progress.

The papers on fossil vertebrates open with an article on the genus *Ancodon* by Dr. Mat-

thew. It announces the discovery of this pig-like genus in the Miocene of North America (hitherto confined to the Eocene and Oligocene), and, in an interesting paragraph, sums up the present views of the author as to its evolutionary history:

> On present evidence we must regard the genus as of Old World origin, probably not African, possibly European, but, considering the relative advancement and geological position of the European and African species, more probably of Asiatic origin.

Dr. Matthew contributes (in collaboration with Harold J. Cook) another paper on "A Pliocene Fauna from Western Nebraska," of which the remarkable features are thus summarized; the separation of fifty species allied to those of the Upper Miocene, but differing (1) in the presence of more advanced species or mutations, (2) Pleistocene or modern genera not hitherto reported from the Tertiary, (3) abundance of three-toed horses resembling the pleistocene *Equus* and *Hippidion,* (4) the remains of gigantic camels of the genus *Pliauchenia.*

Professor Osborn furnishes a paper on "New Carnivorous Mammals from the Fayum Oligocene of Egypt," in continuation of his previous studies on this fauna. The new genus *Metasinopa* is diagnosed from "a nearly complete lower jaw from the upper beds."

Dr. L. Hussakof discusses further the vexed question of the systematic relationship of American Arthrodires, and deposes Eastman's genus *Protitanichthys.* Roy L. Moodie, of the University of Kansas, contributes a paper on "New or Little Known Forms of Carboniferous Amphibia in the American Museum Collections."

Nine articles of varying interest in mammalogy are contributed by L. S. Quackenbush, John T. Nichols, Dr. Allen, Roy C. Andrews and Dr. Elliot. The most extended of these is an account by Dr. Quackenbush of the "Alaskan Mammoth Expeditions in 1907 and 1908." A feature of Mr. Andrews's paper is the photographic reproductions of whales, "sounding," the "slick," inspiration, "lob-tailing," thrashing, diving and spouting.

Mr. Bentenmüller adds five articles, with plates, to his previous papers upon gall-insects. Professor Cockerell discusses the "Fossil Insects of Florissant, Colo."; James A. G. Rehn contributes a long paper (31 text figures) upon the "Orthoptera of Sumatra"; Professor Wheeler is represented by an article upon the "Ants of Formosa and the Philippines," and Aaron L. Treadwell has a note upon an external parasite of eunicidian worms, taken in the Bahamas.

Two remaining papers have considerable value, one by Walter Granger, on the "Faunal Horizons of the Washakie Formations of Southern Wyoming," and some suggestive paragraphs by Dr. W. J. Sinclair on the "Washakie or Volcanic Ash Formation." The summary of the latter comprises a number of informing statements which deserve entire transcription:

> The Bridger rocks are rhyolitic tuffs containing glassy sanidine while the Washakie rocks are andesitic with soda-lime feldspar. From the absence of agglomerates and the fine-grained character of much of the ash it seems probable that it was transported mainly by the wind, and as the prevailing winds are at present from the west and had probably the same direction in Tertiary time, the centers of eruption should be located somewhere in the west or southwest. The absence of agglomerates does not favor the idea of local contemporaneous vents discharging rhyolitic and andesitic ash respectively and the great thickness and uniform petrographic character of each formation is opposed to the conception of rapid variation in the chemical composition of the ash at a single center of eruption. Assuming contemporaneous deposition from two centers of eruption it seems probable, in view of the comparatively short distance separating the areas occupied by the two formations (about fifty miles) that some intermixture of the two types of ash should be found, but the conspicuous absence of plagioclase feldspar from all the Bridger tuffs, and its presence in all those of the Washakie shows that this has not occurred. The lithologic evidence, therefore, does not favor the idea of contemporaneity for any part of the Bridger or Washakie.

Professor Osborn in 1881 upon faunistic evidence had indicated their probable separation.

L. P. GRATACAP

BOTANICAL NOTES

A VERY ANCIENT SEED

What is called "the most primitive seed that has yet come to light" is described by Professor F. W. Oliver in the *Annals of Botany* (Jan., 1909) under the title "On *Physostoma elegans,* an Archaic Type of Seed from the Palaeozoic Rocks." It was first discovered in 1875 by the late Professor Williamson in the Lower Coal Measures of Lancashire, England, who gave it the name used above. In size it is quite small, being from tip to tip only 5.5 to 6 millimeters long. Its integument is ribbed, and at the level of the top of the nucleus the ten ribs become so many separate arms which project beyond the nucellus for a considerable distance. Many pollen cells were found, and these have been sectioned and studied to such good purpose that what appear to be fossil sperms (spermatozoids) have been made out. These are flattened oval bodies occurring in pairs in each pollen cell. That we now calmly accept these results of Professor Oliver's study of these ancient seeds shows what tremendous progress has been made in our knowledge of the general cycad type of seed apparatus, and we even scarcely smile at the author's somewhat naïve statement that "no appendages or cilia have been detected in connection with these bodies" (*i. e.,* the sperms)! The plants that bore these interesting seeds have not yet been traced, but the author refers them provisionally to the Lyginodendreae of the Pteridospermeae (Cycadofilices), and they are without doubt among the earliest of seed-producing plants.

CYTOLOGICAL PAPERS

We can do little more than to enumerate the titles of the cytological papers that lie before us, beginning with "The Stature and Chromosomes of *Oenothera gigas*" (*Archiv für Zellforschung,* Bd. 3, 1909) by R. R. Gates, reaching among others the conclusion that closely related species of plants may differ in the number of chromosomes.—In a concisely written paper, "Cytological Studies on *Oenothera*" (*Ann. Bot.,* Oct., 1909) Dr. B. M. Davis adds many details, by the critical study of the pollen development of *Oenothera grandiflora.*—Other mainly or wholly cytological papers by the same author are "Polar Organization of Plant Cells," "Some Recent Researches on the Cilia-forming Organ of Plant Cells," "Apogamy in the Ferns," "The Origin of Archegoniates," "The Permanence of Chromosomes in Plant Cells," all of which appeared in the *American Naturalist* during the past year or two.—Edith Hyde contributes her mite to the cytological treasury in a paper on "The Reduction Division in the Anthers of *Hyacinthus orientalis,*" in the *Ohio Naturalist* for June, 1909.—"The Embryo Sac of Habenaria" (*Bot. Gaz.,* Oct., 1909) has been carefully studied by W. H. Brown, adding to our knowledge of the embryo sac and the early stages of the embryo.—Professor Schaffner contributes a valuable paper on "The Reduction Division in the Microsporocytes of *Agave virginica*" (*Bot. Gaz.,* March, 1909) bringing out the successive steps in the process.—Dr. A. A. Lawson's paper on "The Gametophytes and Embryo of *Pseudotsuga douglasii*" (*Ann. Bot.,* April, 1909) leads him to the conclusion that "this genus is not closely related to *Tsuga,*" and that "the view that the Abietineae are the most ancient group of the Coniferales is very much strengthened."—A careful cytological study of the "Microsporophylls of Gingko" (*Bot. Gaz.,* Jan., 1910) by Anna M. Starr shows that the microsporophylls are in strobili that develop acropetally, with suggestions that they may have come "from a peltate type like the microsporophylls of *Taxus.*"

SUMMER LABORATORIES

It is not too early for botanists to be planning for their summer outing and study, and so a notice of the prospectuses of waterside and mountain laboratories at this time is not out of place.

The Marine Biological Laboratory at Woods Hole, Mass., offers again courses in Plant Structures and Responses, Morphology and Taxonomy of the Fungi (by Dr. Duggar), besides the usual facilities for research work. It opens June 29 and closes August 9. Dr.

George T. Moore, of the Missouri Botanical Gardens, St. Louis, Mo., is in charge of this work.

The Biological Laboratory at Cold Spring Harbor, Long Island, announces courses from July 6 to August 16, in Cryptogamic Botany, and Ecology, as well as opportunities for investigation. Professor D. S. Johnson, of the Johns Hopkins University, is in charge of the botanical work.

In the interior we have it announced that the second session of the Lakeside Laboratory at Lake Okoboji, Iowa, will extend from June 20 to August 15. Professor T. H. Macbride, Iowa City, Iowa, will be in general charge of the botanical work. Courses are offered in Mycology, the Biology of Aquatic Plants, the Nature of Plants, Histological Methods and Ecology, with opportunities for research work.

In the Rocky Mountains there will be continued from the middle of June to the end of July the University of Colorado Mountain Laboratory at Tolland, Colo., at an altitude of nearly nine thousand feet. Alpine problems will be given especial emphasis. The botanical work is in charge of Professor Francis Ramaley, Boulder, Colo.

PAPERS ON ALGAE

A VERY helpful paper entitled "Hints on Collecting and Growing Algae for Class Purposes," by Professor J. A. Nieuwland, appeared in the October (1909) *Midland Naturalist,* in which the author gives with considerable fulness his methods which he has found to be successful. He encourages us by saying that "as a matter of fact it is not especially difficult to obtain or even to grow the lower plants, and most of them once gotten are easier to keep a long time than the phanerogams." It will repay careful reading by every botanist who has before him the problem of obtaining and maintaining a supply of fresh material of the algae.

The same author in the same number of the journal mentioned ventures a new interpretation of the "knee joints" often observed in *Mougeotia,* namely, that these bendings are the first stages of the fragmentation of the filament, such fragmentation resulting in the formation of as many new filaments.

Ernst Hayren's paper on the "Algae of the Region of Bjorneberg" (in *Proc. Soc. Fauna et Flora Fennica*) is interesting because of the ecological notes that he manages to introduce. He includes observations on Chlorophyceae, Characeae, Phaeophyceae and Rhodophyceae.

"The Life History of *Griffithsia bornetiana*" is worked out in a paper in the October (1909) *Annals of Botany,* by I. F. Lewis. It is more than a report upon the structures which he found in his studies, for he has made it contribute to the discussion of the nature of alternation of generations. The conclusion is reached that in these algae "there is an antithetic alternation of generations, the gametophyte being represented by the sexual plants, the sporophyte by the sporogenous cells of the cystocarp." Five double-page plates beautifully illustrate the paper.

The unicellular fresh-water algae of the Dutch East Indies are described and figured in a recent paper by Dr. Ch. Bernard, and issued as Bulletin XXIV., of the Department of Agriculture at Buitenzorg. Our first remark is upon the significant fact of its issuance by a department of agriculture. Evidently the Netherlandish agriculturists take a very liberal view as to the matter for their bulletins. The desmids and many Protococoideae are taken up in the paper, which is accompanied by six good plates.

Part I. of "The Marine Algae of Denmark," by L. K. Rosenvinge, has appeared as one of the memoirs of the Royal Academy of Sciences and Letters of Denmark. This part includes the introduction of about fifty pages, and about a hundred pages of descriptive text of Bangiales and Nemalionales. This text is well illustrated by text figures. Several maps and plates also accompany the present part. The work as a whole promises to be of great importance.

CHARLES E. BESSEY
THE UNIVERSITY OF NEBRASKA

THE WORK OF THE MARINE BIOLOGICAL STATION OF THE U. S. BUREAU OF FISHERIES, AT BEAUFORT, N. C., DURING THE YEAR 1909

A STEAM launch was available for a portion of the year for the use of the station. Another launch, equipped with a 9 H.P. gasoline engine, was available throughout the year, except for a brief period in the spring when it was detailed to the Edenton station. A large sailing-boat and a number of row-boats were also a part of the general equipment of the station.

A new 30 H.P. boiler was installed in the power-house. This furnished ample power for operating the electric-light plant and for supplying the station with running salt and fresh water. A mess was maintained from the latter part of June to the middle of September by the investigators and assistants. Board cost each member of the mess five dollars per week.

In connection with the experiments of Professor Binford an apparatus was installed for supplying the station with salt water at temperatures higher than that of the surrounding water in the harbor. The apparatus, while not perfected, was practicable, and it is available for similar experimental work in the future.

A large concrete pound, begun late in the previous year, was completed for carrying on experiments looking toward the culture of the diamond-back terrapin. The pound was so arranged as to give the terrapins free access to salt water, marshy land and sand. The experiments with the terrapins were begun too late in the season for securing as good results as would otherwise probably have been obtained. Eggs were laid, however, by the terrapins and a number of the young were hatched. Experiments were begun with a view of rearing the young. At the end of the year the experiments were being carried along successfully. Professor W. P. Hay, of Washington, D. C., had general supervision of the work.

What is planned to be a comprehensive study of the molluscan life of the Beaufort region, including a study of its general relation to the Transatlantic province, was begun with work on the lamellibranchs. Considerable dredging was done as well as other collecting from more accessible places. The material will be supplemented by collections made from the dredging done by the *Fish Hawk* off-shore near Beaufort in 1907.

A detailed study of the breeding habits of the common clam, *Venus mercenaria*, was begun. Work during the summers of previous years, principally by Dr. H. E. Enders, showed that the sexual elements were abundant during the summer season, but that the eggs could be fertilized only sparingly in the laboratory. Examinations made at intervals of about nine days each, beginning the early part of November, showed that eggs and active sperm were present both during November and December. Dr. Enders reached the conclusion that the breeding season of *Venus mercenaria* extends through several months, during which a small quantity of eggs is discharged at short intervals under natural conditions; and it may be that the spawning period extends throughout the year. The temperature, however, may prevent the development of eggs during the colder portions of the year.

The laboratory collection of fishes was increased by a gift of a number of specimens from Mr. Russell J. Coles, of Danville, Va. These specimens were collected from Cape Lookout in 1909. The collection included two specimens of *Narcine brasiliensis* (Ölfers), a species which, it is believed, has not heretofore been recorded from anywhere along our coast north of Florida.

The facilities of the station were utilized by a number of investigators, each working on problems related more or less closely to the work of the bureau. They have kindly furnished abstracts of their work, which are herewith included. They were:

Dr. H. V. Wilson, professor of zoology, University of North Carolina, Chapel Hill, N. C. Dr. Wilson studied the structure, behavior and regeneration of the epidermal layer in some monaxonid sponges (*Stylotella* and *Reniera*). The epidermis in these forms

was found to consist not of separate cells. It is a syncytial nucleated sheet of protoplasm without cell boundaries. The epidermis is regenerated over a cut surface in about twenty-four hours. The union of the mesenchyme cells to form it was followed. Some new facts as to the way in which pores close were made out.

Dr. G. H. Parker, professor of zoology in Harvard University, Cambridge, Mass. Dr. Parker investigated the reactions of the shore sponge, *Stylotella*. No physiological evidence of nervous tissue was found, though the sponge reacted to changes in the environment by opening and closing its oscula and pores, and by moving its body as a whole. These movements were produced by tissue resembling a primitive kind of smooth muscle. They were apparently caused by the direct stimulation of the contractile tissue. The conclusion was reached that in phylogeny muscular tissue had preceded nervous tissue in time of origin.

Dr. E. P. Lyon, professor of physiology, St. Louis University School of Medicine, St. Louis, Mo. Dr. Lyon worked on the following problems: (1) The catalase of echinoderm eggs before and after fertilization. An apparent large increase of catalase is found after fertilization. The results of this investigation were published in the *American Journal of Physiology* for December, 1909. (2) The comparative autolysis of eggs before and after fertilization. The chemical work on this problem has been continued since leaving Beaufort and the results are nearly ready for publication.

Dr. E. W. Gudger, professor of biology in the State Normal College, Greensboro, N. C. Dr. Gudger was chiefly occupied in continuing his investigations of several years' standing on oral gestation in the gaff topsail catfish, *Felichthys felis*, and in collecting material for the study of its embryology. He was successful in pushing back its life history by several days and lacks only the segmentation and invagination stages of having a complete series of eggs and embryos.

He also began a study of the viviparous top minnow, *Gambusia affinis*, and collected various unusual and interesting fishes the data concerning which have been embodied in a paper now in press.

Dr. Alvin S. Wheeler, associate professor at the University of North Carolina, Chapel Hill, N. C. The composition of the sea water at five points near the laboratory was accurately determined. The results agreed closely with each other but showed certain differences from deep-sea waters and shore waters in other parts of the world.

Dr. I. F. Lewis, professor of biology, Randolph-Macon College, Ashland, Va., completed his study of the flora of Shackleford and Bogue banks, and his report has been submitted to the commissioner of fisheries.

After a brief discussion of the geology, soils, physiography and climate of the region, the plant formations are considered. The vegetation is treated under the following heads: I., sand strand vegetation—(1) treeless (open), (2) trees and shrubs (closed); II., marsh vegetation—(1) salt marsh, (2) creek marsh, (3) dune marsh, (4) tidal flat.

Under these heads each plant association is described, and the characteristic species noted. Following this discussion of what may be termed the units of vegetation, a general account of the vegetation of the banks is given, in order to present as clear a picture as possible of the conditions obtaining on the banks at the present time.

The present plant covering was found to be in process of destruction by certain physiographic agencies. Measurements showing the rapidity of action of these agencies are given, and methods suggested for the conservation of the vegetation. In this connection the soil-building and sand-binding plants of the region are described and their value indicated for reclamation work.

The geographical distribution of the plants occurring on the banks is discussed, and comparisons instituted with other points on our South Atlantic coast and with the littoral flora of Alabama. The littoral floras of North and South Carolina and Alabama are found to be typically austro-riparian in char-

acter, though many of the plants common on the mainland are absent from the wind-swept sandy reefs.

The report closes with a classified list of the 268 species of ferns and flowering plants collected. Of these, 11 are new to the flora of North Carolina.

Dr. W. D. Hoyt, Bruce Fellow, Johns Hopkins University, Baltimore, Md., continued the study of the marine algæ, begun in previous summers. This region, unlike most of the southern coast, is found to have a fairly rich algal flora, one hundred and nineteen species being recorded up to the present time. The location of Beaufort, intermediate between the northern and southern regions, makes this flora of special interest, since many forms reach their northern limit here, while others have this for their southern boundary. The presence of a submerged coral reef off the coast gives a supply of subtropical forms on the beach.

The study that is being made includes the conditions of growth, the distribution of the algæ, and the factors controlling this distribution. Collections were made throughout the winter (1908–09) and kept for study, thus giving a view of the algæ throughout the entire year. The work was extended to the coast south of Beaufort, visits being made to nearly every accessible point between this place and Tybee, Ga. Notes were obtained which will furnish interesting comparisons of the distribution and conditions of growth with those of Beaufort. The final report will soon be submitted.

Mr. Raymond Binford, professor of biology in Guilford College, Guilford College, N. C., worked on the life history of the stone crab, *Menippe mercenaria*. A large number of crabs were kept under observation in tanks in the laboratory and in floats at the wharf. From these the spawning habits were observed and the development up to the third larval stage was worked out. The period from spawning to hatching covers eleven to thirteen days, from hatching to the third larval stage about four weeks. At this time they have not yet reached the megalops stage. The strength of the claw muscle was tested and the molting habits observed. Crabs were collected varying in size from 4.5 mm. to 132 mm. across the carapace. A study of the frequency of molting and the increase of size at each molt indicates that they reach the egg-laying size, 56 mm. across the carapace, within a year from the time of hatching. About a thousand of these stone crabs were caught in and about Beaufort Harbor during the summer. There is a ready sale for them at 65 cents per dozen.

Eggs from other species of crabs were hatched in the laboratory, viz., the mud crab, the oyster crab, a crab found in the *Atrina* (*Pinna*) shell, one taken from the *Chætopterus* tube and the blue crab, *Callinectes sapidus*. *Callinectes* was followed through six molts beginning with the megalops stage. It made those molts within a period of thirty-seven days and reached a size thirteen millimeters across the carapace. Some experiments in hatching and rearing the young were undertaken. It is proposed to continue work along this line during the coming summer.

Mr. B. H. Grave, Johns Hopkins University, Baltimore, Md., spent two months at the laboratory studying the anatomy of *Atrina* (*Pinna*) *rigida* Dillwyn. The greater part of the time was spent in injecting and dissecting the vascular system. Experiments were carried on to ascertain the rate and method of the growth of shell and an attempt was made to determine whether the calcium salts, used in shell growth, are taken directly from the sea water or from the blood of the mollusk. The results of this work will soon be ready for publication.

Mr. W. H. Kibler, of the department of science of the Durham High School, Durham, N. C., was engaged in a general study of the fauna of Beaufort and a study of the embryology of *Arbacia, Toxopneustes* and *Turritopsis*. In studying the fauna observations were made upon about forty common forms, and in addition a dozen or more species of fishes were collected and identified. The eggs of *Arbacia* and *Toxopneustes* were artificially fertilized. The development was normal and

reached the stage of the fully developed pluteus. Later stages of young echinoderms were obtained in tows. The eggs of *Turritopsis* developed through the planula stage. Eggs of *Chætopterus* and *Thalassema* were artificially fertilized.

Mr. George W. Corner, 3d, medical student at the Johns Hopkins University, Baltimore, Md., spent the months of July and August collecting and studying the invertebrates.

HENRY D. ALLER,
Director

SPECIAL ARTICLES

PRELIMINARY NOTE ON THE LIFE OF GLACIAL LAKE CHICAGO

EXCAVATIONS made for the new sanitary canal, which will extend from Willmette to the North Branch of the Chicago River at Bowmanville, have disclosed a series of beds filled with organic remains which reveal very fully the characteristic faunas of the several stages of glacial Lake Chicago. The cut at the Bowmanville end of the canal is a mile long; the depth is about twenty-five feet, fifteen of which are in boulder clay (glacial till) undisturbed by water action. The upper ten feet are composed of alternate layers of sand, clay, peaty material and shell beds. These strata quite fully portray the biologic history of the lake.

The area through which the canal is cut lies behind (west of) the Rose Hill bar and the strata exihibited in section were successively the bed or floor of Lake Chicago. These strata may be described as follows: Above the till there is a bed of sand from two to twelve inches in thickness. This doubtless represents the Glenwood stage and, as would be expected, no life is present. Above the sand is a bed ten to eighteen inches thick, composed of clay mixed with peaty matter, logs of wood and leaves of trees (oak and spruce). Molluscan shells of the genera *Planorbis, Physa, Lymnæa, Ancylus, Sphærium, Pisidium* and *Amnicola* abound. The presence of this extensive deposit, which can be traced the entire length of the canal, beneath deposits unquestionably of Calumet time, strongly supports, if indeed it does not prove, the early contention made by Dr. Andrews of a post-Glenwood low-water stage. The species of mollusks are mostly those found in swamps or along the edges of shallow bays or lakes.

Above the clay is a deposit of sand and gravel, two to nineteen inches in thickness, on the surface of which is one of the thickest beds of naiades the writer has ever seen. There are upwards of a dozen species, including *Unio gibbosus, U. crassidens, Quadrula undulata, Q. rubiginosa, Q. trigona, Q. verrucosa* and *Q. pustulosa.* With these are associated *Campeloma, Sphærium* and *Goniobasis.* The shells are species which frequent large streams of more or less rapidly flowing water, as the Illinois and Mississippi rivers, which fact, together with the unassorted character of the sand and gravel, shows that there was a rapid flow of water from the lake to the Desplaines outlet behind the Rose Hill bar. This deposit is believed to represent the Calumet stage. The presence of *Unio crassidens* is of great interest, as this species is not now found north of La Salle County in Illinois.

Above the Naiad deposits there are alternate beds of clay and sand, with occasional pockets of shells, the aggregate thickness being about thirty-two inches. The presence of peaty matter and wood afford evidence of a second low-water stage. In one of these deposits the humerus of a small bird was found as well as several fish spines.

Above this deposit there is a bed of molluscan shells forming a compact mass from one and one half to five inches in thickness. These are of swamp or bay species of the genera *Lymnæa, Planorbis, Physa, Valvata, Campeloma, Amnicola, Sphærium, Pisidium,* etc. Naiades are uniformly absent. This deposit was formed during the early portion of the Toleston stage, when the area behind the Rose Hill bar formed a reed-bordered bay. Above the shell bed is a deposit of clay seven to twelve inches in thickness, and above this, a typical peat deposit three and one half to eight inches in thickness. This deposit was formed in a small lake or pond, as it is of small extent. The region at this time was of

a swampy nature and contained numerous summer-dry ponds, similar to those found in the Skokie Marsh area. Above the peat deposit the surface soil is about two feet in thickness.

It has been stated by Goldthwait[1] and others[2] that there are no certain traces of life in the lake during the Glenwood and Calumet stages. It may be true that life was not abundant during the early part of the Glenwood stage, but the evidence afforded by the deposits discussed above conclusively prove that life was abundant during late Glenwood time, very abundant during Calumet time and has continued to be so to the present time, for the Chicago River as well as the smaller streams and summer-dry ponds in this area now teem with molluscan life.

The presence of a species of spruce (*Picea evanstoni*) as well as an oak (*Quercus marceyana*) has led to the belief that a climate similar to that of Alaska prevailed during the early part of the period (Glenwood) during which Lake Chicago was forming. The presence of *Unio crassidens,* essentially a southern species, in the Calumet deposit, indicates, apparently, a period of higher temperature during this later time. That this species had a much more northern distribution during early postglacial time is evidenced by its presence in a deposit at Green Bay, Wisconsin.[3]

The northern records of *crassidens* may be tabulated as follows:

	South of Green Bay Record
Wisconsin, between Prairie du Chien and De Soto[4]	80 miles.
Minnesota, not recorded.	
Iowa, Lansing[5]	80 miles.
Michigan, not recorded.	
Illinois, Utica, La Salle Co.[6]	220 miles.
Ohio, Scioto River[7]	260 miles.
Indiana, Tippecanoe River[8]	230 miles.

[1] Bull. Ill. Geol. Surv., No. 7, p. 63, 1908.

[2] Alden, "Geol. Atlas of U. S.," Chicago Folio, No. 81, p. 11, 1902.

[3] Wagner, *Nautilus,* XVIII., pp. 97–100, 1905. This specimen has been personally examined.

[4] Chadwick, *Bull. Wis. Nat. Hist. Soc.,* IV., p. 95, 1906.

The most northern extension of this species at the present time is in the Mississippi River, where it has been collected as far north as Prairie du Chien and probably lives as far north as De Soto. In Illinois and Indiana the northern range is 150 miles farther south. *Crassidens* is essentially a southern species, abundant in the southeastern part of the United States where its center of distribution is in the neighborhood of Tennessee. Its northern extension indicates a more genial climate than that which now prevails in the northern states. The route of migration to Green Bay is difficult to predict with certainty. The Lake Chicago fauna undoubtedly migrated up the Mississippi-Illinois-Desplaines Rivers. It is interesting to note that the species associated with *crassidens* are typical of a temperate climate and are, for the most part, living in this region at the present time.

It is very important that records of *crassidens,* both fossil and recent, be secured in Wisconsin, Michigan and northern Illinois, Indiana and Ohio. It is possible that the bed of glacial Lake Maumee would reveal strata similar to those observed in Lake Chicago, and as *crassidens* is found in the Wabash River, it may have migrated into Lake Maumee.

Studies on this subject are not now far enough advanced to warrant generalizations. A report illustrated by photographs and stratigraphical sections, and with tables of the species, together with their geographic distribution, past and present, is in preparation. The writer would solicit authentic northern records of *crassidens* for the purpose of establishing the present geographic distribution of this species. It would also be of great value if *crassidens* could be discovered in postglacial deposits in Wisconsin and Michigan, as well as in northern Ohio and Indiana. Full credit

[5] Museum record.

[6] Baker, Bull. Ill. State Lab. N. H., VII., p. 77, 1906.

[7] Sterki, *Proc. Ohio Acad. Sci.,* IV., p. 392, 1907.

[8] Daniels, 27th An. Rep. Dept. Geol. Ind., p. 650, 1902.

will be given in the final report for any assistance of this character, should such be submitted to the writer.

FRANK C. BAKER,
Curator

CHICAGO ACADEMY OF SCIENCES

COLLETOTRICHUM FALCATUM IN THE UNITED STATES

DURING the past two years, while studying the diseases of sugar-cane, careful search has been made for those which are troublesome in other countries but which are not known to occur in the United States. During the past year one of these has been found in Louisiana, and from material received from another state, this may be more widely distributed than was at first thought. This disease is one which is caused by the fungus *Colletotrichum falcatum* Went. This has been reported previously in nearly every sugar raising country in the world, in some places doing a large amount of damage. According to Butler[1] this fungus sometimes causes an immense loss in Bengal. Several common names have been applied to this disease, but the one in most common use in English-speaking countries is the red-rot disease.

The first specimen of this disease was found on a plantation in Orleans parish, Louisiana, in September, 1909. One cane was found which had a lesion about two centimeters in diameter which was covered with the fruiting pustules of this fungus. No other diseased stalk was found in the field. I was not willing to make a positive identification at the time because the causative fungus is very similar to *Colletotrichum lineola* Cda., which occurs very abundantly on Johnson Grass in this region, and it was barely possible that this latter fungus had gained an entrance into a wound in the cane. But since other material has been received there seems little doubt but what this was the true red-rot fungus.

[1] Butler, E. J., "Fungus Diseases of the Sugar-cane in Bengal," *Memoirs Dept. Agr. in India*, Botanical Series, Vol. I., No. 3, Pusa, 1906.

During the fall and winter of 1909 and 1910, a planter in Georgia, Mr. W. B. Roddenbery, of Cairo, who has had considerable trouble with a disease in his cane wrote to the sugar station at New Orleans and also sent specimens. This material was resent to me and I have since made a careful study of the trouble. There is no doubt but that it is the red-rot disease in a very serious form. He estimates that one third of the cane which he wished to use for planting was diseased.

As this disease is generally confined to the inside of the stalk, an examination of the external part usually shows but very little of the trouble. Unless the cane is severely affected the disease would ordinarily be overlooked, unless it was examined very carefully or unless the stalks were split. However, when the cane is severely affected, the rind covering the nodes, and even strips on the internodes, become dark brown in color, and the eyes are usually dead. If the stalks are split, the nodal region will be found to be badly decayed, with strips of red and brown extending out into the internodes. One of the distinguishing characters of the disease is the presence of light-colored spots surrounded by red or brown tissue. These were fairly abundant in the Georgia material. These have not been satisfactorily explained but it appears as if they are points where the fungus is present, it generally not being present in the red and brown surrounding tissue.

The fungus was found fruiting in some large internodal lesions on some soft top joints of one stalk, on the brownish colored nodes of two stalks, and also fruited on a split stalk that was kept moist. In the latter case, the fruiting postules developed directly from the diseased center of the node. A microscopical examination of the diseased tissue of the cane showed the presence of the typical mycelium and many of the so-called "appressoria" in the host cells.

This fungus is very similar, if not identical from a morphological standpoint, to *Colletotrichum lineola* Cda., mentioned above. The latter fungus has also been studied and inocu-

lation experiments have been tried on sugar cane but without success. The fungus would grow, and also fruit to some extent, at the point of inoculation, but would not spread into the healthy tissue.

C. W. Edgerton

Louisiana Agricultural Experiment Station

SOCIETIES AND ACADEMIES

THE GEOLOGICAL SOCIETY OF WASHINGTON

At the 229th meeting of the society, held at the George Washington University on Wednesday evening, March 9, 1910, informal communications were presented as follows:

Mr. Chas. A. Davis exhibited a map showing the distribution of workable peat deposits in the United States and their relation to the areas of glaciation and heavy precipitation.

Mr. E. G. Woodruff presented a diagram constructed from measurements made along an outcrop of coal beds in central Wyoming, showing their pronounced lenticular character.

Mr. J. T. Pardee exhibited photographs and a sketch map of the region covered by the former glacial Lake Missoula, which once occupied some 4,500 square miles in the drainage basin of the Clark Fork in northwestern Montana and was dammed by a south flowing ice tongue of the Cordilleran ice cap near Lake Pend d'Oreille.

Regular Program

A Microscopical Study of some Sulphide Ores: F. B. Laney.

A Proposed Classification of Petroleum and Natural Gas Fields based on Structure: Frederick G. Clapp.

The classification is a tentative one which was evolved at least in part in order to illustrate to oil operators the differences in geological conditions in different fields. The main divisions of the classification are as follows: (I.) Anticlinal and synclinal structures; (*a*) strong anticlines standing alone, (*b*) well-defined anticlines and synclines alternating, (*c*) monoclinal slopes with change in dip, (*d*) terrace structures, (*e*) broad geanticlinal folds. (II.) Domes, or quaquaversal structures (Salines). (III.) Sealed faults. (IV.) Oil and gas sealed in by asphaltic deposits. (V.) Contact of sedimentary and crystalline rocks. (VI.) Joint stacks.

As examples of subclass I. (*a*), the fields on the Eureka-Volcano-Burning Springs anticline of West Virginia and certain California fields are given. In subclass I. (*b*) are placed most of the fields related to anticlines and synclines in the Appalachian province, the Caddo field of Louisiana, the Coalinga and Los Angeles fields of California and the Burma and other well-known fields in other countries. The majority of the oil and gas pools of southeastern Ohio belong in division I. (*c*), or in I. (*d*) which is an exaggerated form of I. (*c*). The best example known of subclass I. (*e*) is stated to be the extensive field on the Cincinnati anticline in Ohio and Indiana. Class II. includes the fields of the gulf coastal plain. Class III. is exemplified by certain pools in the Lompoc field and perhaps other fields of southern California. Class IV. is somewhat hypothetical, so far as oil and gas accumulations of economic value are concerned, but it may be exemplified by the pitch lake of Trinidad. Class V. is known to exist in the Province of Quebec and to some extent in northern New York state, where natural gas is found in the arkose zone of the Potsdam sandstone resting on prominent knobs in the underlying crystalline rocks. Class VI. was added after the discussion in accordance with a suggestion by Mr. M. R. Campbell. An example of it is a part, at least, of the Florence oil field in Colorado. In illustrating the proposed classification, several notable deficiencies in past assumptions of geologists and oil operators were mentioned, and the lessons to be drawn from them in the light of recent developments were emphasized.

Some Notes on the Mammoth Cave, Kentucky: James H. Gardner.

The Mammoth Cave is essentially a product of solution in the St. Louis Limestone, which in this section of Kentucky is about 500 feet thick. Meteoric waters charged with carbonic acid gas began permeation of joint planes in the limestone as soon as Green River had cut its channel through the Kaskaskia sandstone into the St. Louis. In the opinion of the speaker these joints were produced by pressure exerted from the Cincinnati Arch either by movements of uplift or subsequent settling. The drainage of this section of Kentucky is chiefly underground where the St. Louis is the surface rock and the formation is one abounding in subterranean caverns.

The present entrance to the cave, which is in the hills bordering the east banks of Green River, is doubtless the original exit of Echo River, though this stream has found lower outlets from time to time and is now about 195 feet below this level. Writers on the cave have considered this

entrance in the light of its being an opening produced by falling in of the roof. It has this appearance due to the accumulation of talus in front of the mouth.

Brief references were made to the fauna of the cave in its relation to the effects of environment in the origin of species. Physical and geological phenomena were discussed including the movements of air currents, origin of calcium nitrate, deposits of calcium carbonate and gypsum rosettes.

FRANCOIS E. MATTHES,
Secretary

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

THE thirty-eighth meeting has held at the Cornell University Medical College on Wednesday, April 20, 1910, at 8:15 P.M., with President Morgan in the chair. An executive meeting was held.

New members elected: Anna W. Williams, Katharine R. Collins, A. J. Goldfarb and Herman M. Adler.

Members present: Atkinson, Auer, Beebe, R. I. Cole, Cooke, Crile, Dochez, Ewing, Foster, Gies, Jackson, Jacobs, Joseph, Kast, Lamar, Lee, Levin, Leo Loeb, Lusk, MacCallum, McClendon, Meltzer, A. Meyer, Morgan, Murlin, Noguchi, Opie, Pearce, Rous, Shaffer, Shaklee, Torrey, Van Slyke, Weil, Wolf.

Scientific Program

"On the Behavior of Autodermic and Isodermic Skin Grafts in Cancer," G. W. Crile.

"Further Observations on the Hemolysis in Cancer," G. W. Crile.

"On the Neurocytologic Changes in Shock, Infections, Grave's Disease and with Certain Drugs," G. W. Crile.

"On Yeast Nucleic Acid," P. A. Levene and W. A. Jacobs.

"The Contact Irritability of the Uterine Mucosa," Leo Loeb.

"Adsorption of Venom of Heloderma," Leo Loeb and M. S. Fleisher.

"A Note on Parabiosis between Mice and Rats," R. A. Lambert.

"A Demonstration of the Inhibitory Effect of Magnesium upon Normal and Artificial Peristalsis of the Stomach and the Duodenum," D. R. Joseph and S. J. Meltzer.

"Recovery from Fatal Doses of Strychnine by the Aid of Curarin and Artificial Respiration (Insufflation Method)," A. O. Shaklee and S. J. Meltzer.

"Intracellular Proteolytic Enzymes of the Liver," A. R. Dochez.

"Enzymes and Antienzymes of the Blood Serum with Certain Degenerative Changes in the Liver," Eugene L. Opie and B. I. Barker.

"A Preliminary Note on Experimental Lobar Pneumonia with a Demonstration of Specimens," R. V. Lamar and S. J. Meltzer.

"Experiments bearing on the Nature of the Karyokinetic Figure," T. H. Morgan.

"The Effect of Vagus Section upon Serum Anaphylaxis in Guinea-pigs," J. Auer.

"Notes on the Vaso Reaction in Dogs produced by Injections of Extracts of the Tubercle Bacillus," J. P. Atkinson and Charles B. Fitzpatric.

"Immunity to the Growth of Cancer induced in Rats by Treatment with Mouse Tissue," Isaac Levin.

"The Early Stages of the Spontaneous Arterial Lesions in the Rabbit," Isaac Levin and John H. Larkin.

(A) "Artificial Cyclopia in the Smelt," (B) "Cataphoresis of Proteids in the Living Cell," J. F. McClendon.

"Nitrogen and Sulphur Metabolism in Morbus Ceruleus," N. B. Foster.

The following communications were read by title:

"Parenteral Protein Assimilation," P. A. Levene and G. M. Meyer.

"A Method of Isolating the Cerebro-medullary Circulation," Arthur B. Eisenbrey.

"A Reversion of the Starch-dextrin Reaction," Edward T. Reichert.

(A) "The Rôle of Alkali in the Development of the Egg of the Sea-urchin," (B) "How can the Process Underlying Membrane Formation cause the Development of the Egg?" Jacques Loeb.

"An Investigation of the Place of Formation of Immune Bodies by the Method of Organ Transplantation," A. B. Luckhardt.

"The Concentration of Ammonia in the Blood of Dogs and Cats Necessary to produce Ammonia Tetany," Clara Jacobson.

"The Non-production of Sugar from Tyrosin and Glucosamin in Phlorhizin Glycosuria," A. I. Ringer and Graham Lusk.

"The Daily Curve of Nitrogen Elimination in the Pregnant, as compared with the Non-pregnant Dog," J. R. Murlin.

"Rate of Contraction of Muscle under the Influence of a Voluntary Stimulus," H. B. Williams.

"Filtration through Collodion Sacs," Edna Steinhardt.

"The Activation of Pancreatic Extract," A. R. Dochez.

EUGENE L. OPIE,
Secretary

THE AMERICAN CHEMICAL SOCIETY
NEW YORK SECTION

THE seventh regular meeting of the session of 1909–10 was held at the Chemists' Club on Friday, April 8.

Dr. F. D. Dodge read a paper entitled "Notes of the Determination of Essential Oils."

The remainder of the program consisted of a symposium on leather, arranged by Dr. Allen Rogers, which included the following papers:

"General Outline of the Industry," Allen Rogers.

"The Process of Bating," Alan A. Claflin.

"Vegetable Tanning Materials," John H. Yocum.

"Recent Advances in Chrome Tannage," Otto P. Amend.

"The Coloring of Leather," F. E. Atteaux.

"Oils used in the Leather Industry," Edgar A. Prosser.

C. M. JOYCE,
Secretary

THE UTAH ACADEMY OF SCIENCES

THE third annual meeting of the academy was held at Salt Lake City, on Friday and Saturday, April 1–2, 1910.

The sessions opened at 8 P.M. Friday evening and 2 P.M. Saturday afternoon. President W. C. Ebaugh occupied the chair.

At the annual election held on Saturday afternoon, the following officers and members of the council were chosen:

President—Dr. E. D. Ball, Utah Experiment Station, Logan.

First Vice-president—C. C. Spooner, Salt Lake High School.

Second Vice-president—Dr. S. H. Goodwin, Proctor Academy, Provo.

Secretary—A. O. Garrett, Salt Lake High School.

Treasurer—John B. Forrester, Salt Lake City.

Councilors-at-large—Professor Marcus E. Jones, Dr. C. T. Vorhies, A. F. Greaves-Walker.

The following papers were read at the annual meeting:

"A General Survey of the Jurassic of Southeastern Utah," John B. Forrester, Salt Lake City.

"Mendelism," Dr. E. D. Ball, Utah Experiment Station, Logan.

President's address, Dr. W. C. Ebaugh, University of Utah, Salt Lake.

"Preliminary Report on the Animals of Great Salt Lake," Dr. C. T. Vorhies, University of Utah, Salt Lake City.

"Recent Analyses of Water from Great Salt Lake," Wallace Macfarlane, Salt Lake City.

"Preliminary Report of the Plants of Great Salt Lake," L. L. Daines, University of Utah, Salt Lake City.

"Recent Progress in Economic Entomology," Professor E. G. Titus, Utah Agricultural College, Logan.

"Efflorescence or Scum on Brick Work," A. F. Greaves-Walker, Salt Lake City.

"A Reported Occurrence of Native Iron in Utah," Dr. W. C. Ebaugh, University of Utah, Salt Lake City.

"The Composition of Solids Precipitated from the Atmosphere during 'Salt Storms,'" Dr. W. C. Ebaugh.

A. O. GARRETT,
Secretary

ST. LOUIS SECTION, AMERICAN CHEMICAL SOCIETY
ST. LOUIS CHEMICAL SOCIETY

THE following papers have been presented before these two affiliated chemical societies, at the meetings held in January, February, March and April, 1910.

"Timber Preservation," Messrs. A. L. Kammerer and E. B. Fulks.

"The Action of Magnesium upon the Vapors of Organic Compounds," Professor E. H. Keiser.

"The Extraction of Glycerine from Soap Lye," Mr. Clarence B. Cluff.

"Chemistry in America and Germany," "Electrolytic Preparation of Hydrazine," Mr. R. F. Weber.

"Terpeneless Extract of Lemon, and Methods of Analysis thereof," Dr. S. H. Baer.

"A Rapid Method of Estimating Iron in Iron Ores," Dr. LeRoy McMaster.

"Ozone in Water Treatment," Mr. W. F. Montfort.

The two societies also have visited the plants of the Laclede Gas Light Company and of the N. K. Fairbanks Co., the plant of the latter company, in St. Louis, being engaged in the manufacture of laundry soap and washing powder.

R. NORRIS SHREVE,
Sec. St. Louis Sec. Amer. Chem. Soc.
GEO. LANG, JR.,
Rec. Sec. St. Louis Chem. Soc.